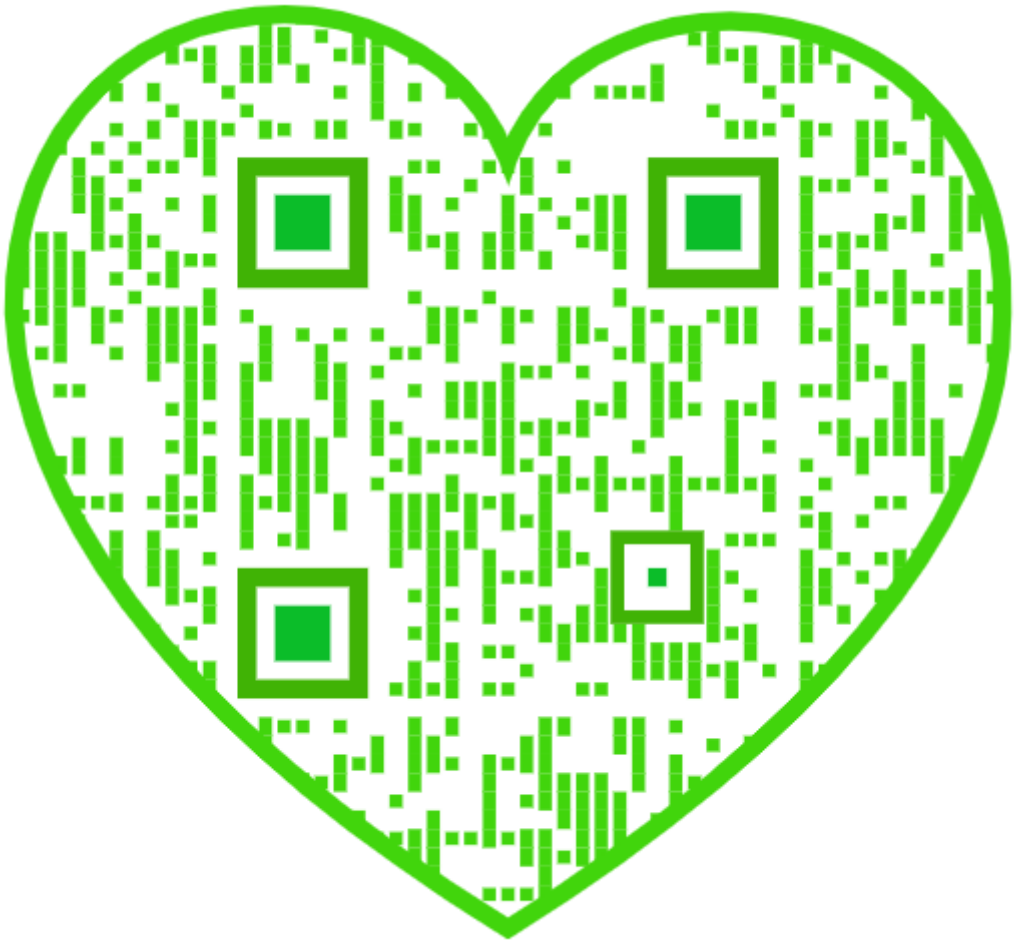

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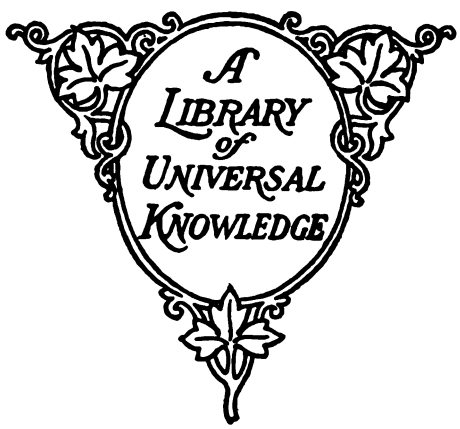

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KEY TO PRONUNCIATION.

ā	far, father
ā	fate, hate
a or ă	at, fat
ā	air, care
ạ	ado, sofa
â	all, fall
ch	choose, church
ē	eel, we
e or ĕ	bed, end
ė	her, over: also Fr. *e*, as in *de; eu*, as in *neuf;* and *oeu*, as in *boeuf, coeur;* Ger. ö (or *oe*), as in *ökonomie.*
ę	befall, elope
ē	agent, trident
ff	off, trough
g	gas, get
gw	anguish, guava
h	hat, hot
h or H	Ger. *ch*, as in *nicht, wacht*
hw	what
ī	file, ice
i or ĭ	him, it
ị	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
j	gem, genius
kw	quaint, quite
ṅ	Fr. nasal *m* or *n*, as in *embonpoint, Jean, temps*
ñ	Span. *ñ*, as in *cañon* (căn'yŏn), *piñon* (pēn'yŏn)
ng	mingle, singing
nk	bank, ink
ō	no, open
o or ŏ	not, on
ô	corn, nor
ȯ	atom, symbol
ọ	book, look
oi	oil, soil; also Ger. *eu*, as in *beutel*
ö or oo	fool, rule
ou or ow	allow, bowsprit
s	satisfy, sauce
sh	show, sure
th	thick, thin
ṯh	father, thither
ū	mute, use
u or ŭ	but, us
u̇	pull, put
ü	between u and e, as in Fr. *sur*, Ger. *Müller*
v	of, very
y	(consonantal) yes, young
z	pleasant, rose
zh	azure, pleasure
′(prime), ″(secondary)	accents, to indicate syllabic stress

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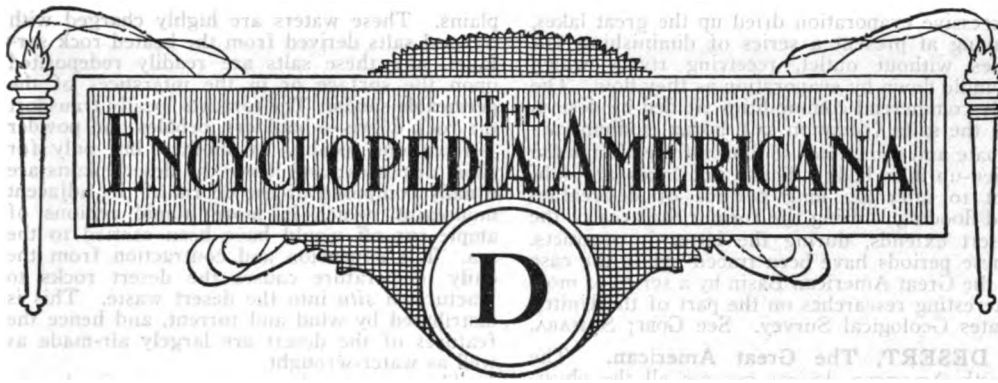


DESERT, a term designating in its broadest application any uninhabited region. In its more ordinary use the word means a portion of the earth's surface that on acount of its barrenness cannot support inhabitants. Four classes of desert may be distinguished: (1) Ice-wastes occupy the central plateau of Greenland, the islands of the Arctic Sea, and probably the entire Antarctic continent. (2) Tundras (q.v.) are flat plains, little elevated above sea-level, fringing the Arctic shores of the northern continents and especially characteristic of Siberia. (3) Temporary deserts, or steppe-lands, border the Asiatic deserts to the north and west: The saline steppes of the Caspian are true arid wastes; but the typical steppes in South Russia are luxuriantly clothed with verdure and flowers in spring. In the dry season they form a dusty plain of withered herbage. The llanos (q.v.) of the Orinoco have similar characteristics, but the pampas of South America include portions perennially green and suitable for agriculture. (4) Arid wastes, or deserts in the popular sense of the word, occur mainly in two zones encircling the world, and corresponding to regions of minimum rainfall. The greater zone extends from near the equator in an east-northeast direction across the whole breadth of North Africa, as the Great Sahara, Libyan and Nubian deserts, over the peninsula of Arabia, through Persia, Turkestan and the vast tracts of Gobi or Shamo to the confines of China. The zone, thus traced throughout the breadth of the ancient continent from western Africa to long. 120° E., has been computed to cover an area of 6,500,000 square miles; but the Asiatic portion of this tract includes many chains of mountains and fertile valleys. The great Indian Desert in the Punjab is the only extension of this belt south of the Himalayas. The ring is completed by the Great Basin of North America in lat. 40° N. The southern zone, less complete, comprises the Kalahari Desert in southwest Africa, the interior of Australia and districts in Chile and in the Argentine Republic.

Deserts occur at all elevations, from considerable depth beneath sea-level to many thousand feet above it, and with all varieties of surface, from a flat expanse of sand, where the view for days of travel is bounded by a sharp circle as at sea, to rocky mountain slopes rent by rough defiles bare and chiseled by the driving sand. The essential character of an arid waste is its rainlessness, and the scarcity of water on the surface and of water vapor in the atmosphere. Radiation in the clear air is rapid and desert climate is consequently of an exaggerated continental type. The sand in the Sahara becomes heated to over 150° F. during the day, and chilled below the freezing point at night, while the diurnal and seasonal extremes in the lofty deserts of central Asia are much greater. Thus desert-regions are most effective in producing land and sea breezes and monsoon winds in consequence of the marked periodical changes in atmospheric density. Another effect is the mirage (q.v.), a phenomenon which, combined with the great loneliness that oppresses the occasional traveler, probably accounts for the widespread superstitions peopling deserts, above all other places, with evil and malicious spirits. The dreaded sand storm or simoom is a kind of tornado or whirlwind which raises the sand in tall rotating columns sweeping over the surface with tremendous velocity. Sand-dunes sometimes several hundred feet in height are raised by steady winds, and gradually shift their position. The rocks of desert regions are usually worn into fantastic shapes by wind-drifted sand, and many plains are strewn with «desert pavements» of pebbles, the harder remnants of the rocks etched away by natural sand blast erosion. Desert vegetation is extremely scanty, consisting mainly of hard prickly plants of the cactus, euphorbia and spinose kinds, whose surface exhales little moisture. Animal life is correspondingly restricted both in variety and number of individuals. The camel is par excellence the beast of burden for conducting traffic across arid wastes. When an overflowing river, such as the Nile, traverses a desert, the land becomes richly fertile in its immediate neighborhood, and wherever springs bubble up through the sand there are oases, bearing palm trees and grass. Artificial irrigation, especially the sinking of artesian wells, has done much to reclaim tracts of desert for agriculture in the Sahara and to a less extent in Australia, while the area of arid land in the western part of the United States, once considered irreclaimable, is being rendered by irrigation increasingly productive.

Geological considerations show that arid deserts are not permanent features of the earth's surface. The most level expanses are believed by many to have once formed part of the ocean bed, or at least great inland seas. The orographical changes which cut off these seas and created inland drainage areas probably at the same time modified the rainfall of the locality.

Excessive evaporation dried up the great lakes, leaving at present a series of diminishing salt lakes without outlet, receiving rivers which dwindle down by evaporation as they flow. The only commercial commodities yielded by deserts are the salts (common salt, borax, sodium carbonate and sometimes sodium nitrate) left in the dried-up lake beds. These salt lakes are subject to alternate long periods of desiccation and flooding; during the former the area of the desert extends, during the latter it contracts. These periods have been traced out in the case of the Great American Basin by a series of most interesting researches on the part of the United States Geological Survey. See GOBI; SAHARA.

DESERT, The Great American. The North American deserts possess all the physiographic, geologic and climatic elements which distinguish the African desert of Sahara. The chief difference between the two regions is the relatively larger area of the Sahara, the arrangement of the topographic units and the occurrence in the Great American Desert of a wealth of mineral resources which the Sahara does not possess. Through the application of modern mechanical agencies by American energies and brain, its wastes have become inhabited by an intelligent and progressive people, and its arid hills and plains made to yield a wealth twice as much per capita as that of any other portion of the United States.

The vast stretches lying between the Sierra Nevada and California and the eastern Cordilleran ranges (Rocky Mountains) in the United States, and between the Pacific Ocean and the eastern Sierra Madre of Mexico, constitutes the Great American Desert.

Of the total area of the Cordilleran province, three-eighths are forested mountains, one-eighth plateau and one-half waterless, treeless, turfless mountain and valley desert. The deserts occur in Nevada, Utah, eastern and southern California, Arizona, New Mexico and all of Texas west of the Pecos, 550,000 square miles. The American Desert is international, however, for in addition to the above area within the United States, it continues southward into Mexico, where it includes most of the states of Sonora, Chihuahua, Coahuila, San Luis Potosí and Sinaloa — another 500,000 square miles — making a total of 1,050,000 square miles, which although one-third the area is as truly a desert in every natural sense as is the Sahara, which embraces an area of 3,500,000 square miles, and has a population of 2,500,000 people.

In its entirety (with a few exceptional forested summits) this desert province is one of barren, stony mountain ranges, separated by equally barren stretches of desert plain, an aggregation of elongated arid plains and lower mountain ranges, which mostly follow the avial line of the Cordilleras. The individual deserts have many names, and each differs from the other in some minor aspects.

From a technical point of view an arid desert in its ultimate analysis is a region in which the rainfall is insufficient to produce run-off. The light rainfall, striking the heated rock surfaces and sandy soils, is soon evaporated or drunk in; even the large bodies of water which may start down the mountain sides as roaring torrents usually die out at the margins of the plains. These waters are highly charged with mineral salts derived from the heated rock surfaces, and these salts are readily redeposited upon the surface or in the interstices of the permeable sands. The torrents locally transport the rock débris — boulders, pebbles and powder — from one locality to another, but only for short distances; and hence the desert plains are usually composed of the débris of the adjacent mountains, which in more humid regions of ample run-off would have been carried to the sea. The expansion and contraction from the daily temperature causes the desert rocks to fracture *in situ* into the desert waste. This is distributed by wind and torrent, and hence the features of the desert are largely air-made as well as water-wrought.

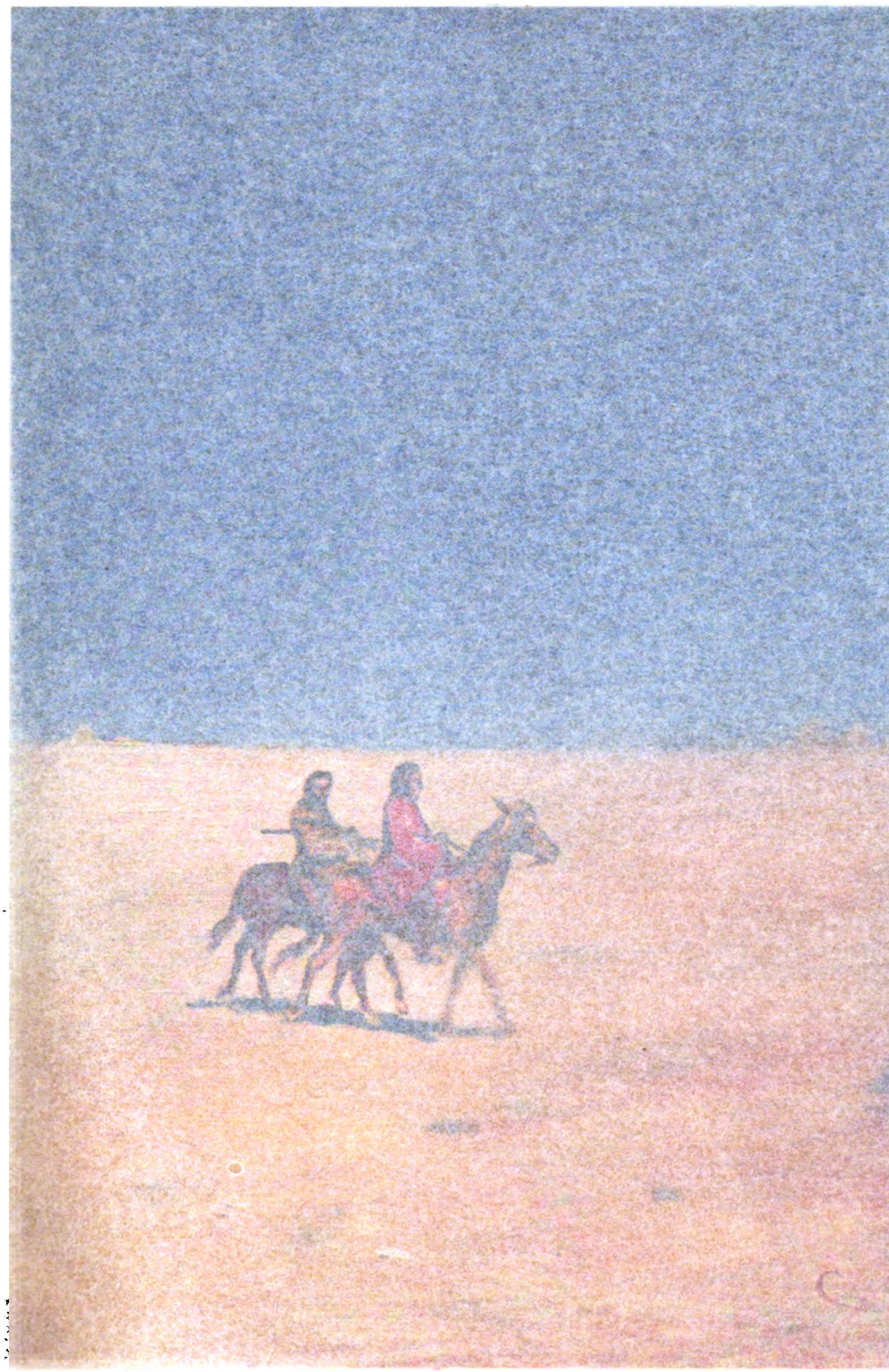
The scarcity of moisture results in the absence of vegetation of the root-twining, soil-gathering and soil-making type that distinguishes the humid region. Every plant and species attests the aridity of the country. Exactly as in the Sahara, these plants are thorny, coriaceous bushes and shrubs of the cactus, aloe and acacia families, adapted to withstand their droughty environment and to defend themselves from attack by man or beast.

Physiographically there are two sub-provinces of the Great American Desert, lying to the east and to the west of the western Sierra Madre and Colorado Plateau, respectively. The westernmost of these may be termed the Nevadan and the eastern the Chihuahuan. The western, or Nevadan, Desert occupies much of the area of Utah, Nevada, Arizona, southern and eastern California in the United States, and the states of Sonora and Sinaloa in Mexico. The Chihuahuan Desert occupies the vast area of country lying between the eastern and western Sierra Madre of Mexico and their northern continuation into southern New Mexico and Texas west of the Pecos, and is the so-called Mexican Plateau.

The Great Basin Desert is marked by wide flatness and is largely a region of ancient lake beds. Its surfaces are in many instances what the geologists term constructional, built up largely of great alluvial fans or piedmont alluvial plains, constituting the so-called filled valleys of the inter-montane belts. Its flora is mostly sage brush and grease wood; its agricultural products are cereals and tubers, and minerals gold, silver and copper. The Sonoran Desert is of a more complicated geological type, and instead of being land-locked is bordered on one side by the Pacific Ocean. Some of its surfaces are also the result of what geologists term destructional processes. Its floral types are the saguara, the palo verde and the catsclaw. Its sparse agricultural products are fruit and wheat, its mineral resources gold and copper.

The Chihuahuan Desert, marked by parallel plains and ranges, is a relatively higher region; its features are a combination of destructional and constructional processes. Its floral types are the maguey cactus and yucca; its chief agricultural product maize (corn), and its principal mineral product silver.

While the desert plains may be extensive, they also have many phases of variation. There are the alkali plains, while crystal patches of saline efflorescence which vegetation abhors, and vast plains of "doby" (adobe) — brownish choc-



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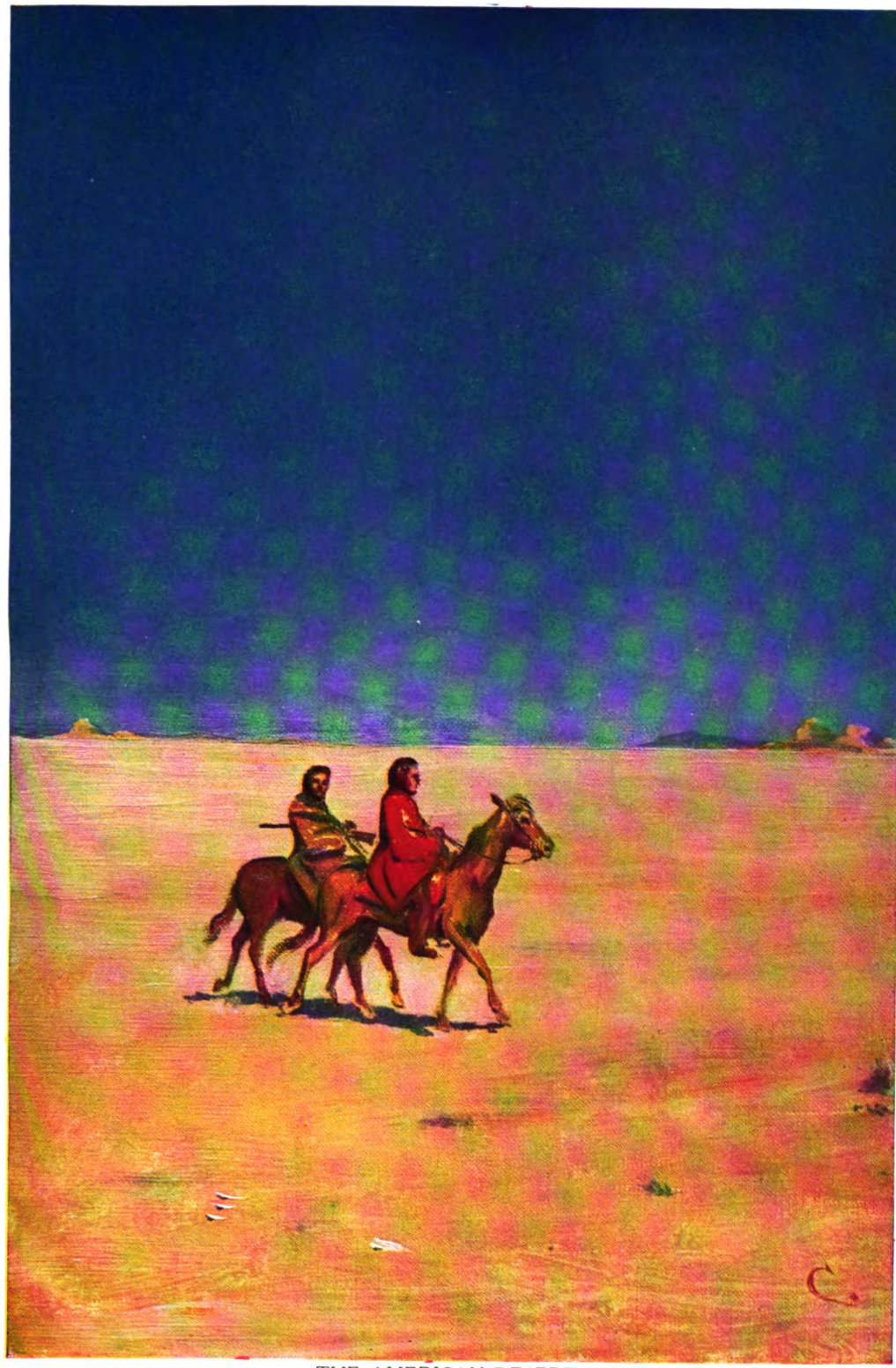


THE AMERICAN DESERT

olate clay soils through which here and there are cut the deep channels of streamless streams, or arroyos. There are the dreary "tabosa" flats covered by the headlike bunches of a woody grass, abhorred by animals and useless to man, through which one may travel for days. The great white gypsum desert of the Tularosa Valley of New Mexico is one of the most wondrous of all the desert plains. To the eye it is a veritable sea of purest granular snow, marked with wind waves and ripples like the Tropic Ocean, with billows and troughs. In some places there are extensive lakes of crystalline salt which the desert inhabitant uses for herd and flock. Sometimes there are stretches of dreary brown sand hills, great billows gathered around the protecting roots of the thorny mesquite, the particles blowing with each breath of wind.

The half cannot be told of the many other aberrant features of the Great American Desert, like Death Valley; the great "medanos" or white sand dunes just south of El Paso, each as high as the national capitol, which creep from place to place over the desert plain; the vast plains of malpais in New Mexico with their burning, cutting, black, waterless surfaces of lava; the "flour dust" deserts of Jimenez and Arizona and Sonora, where the traveler is choked with clouds of chalk-white powder; the Crow Flat with its glare that blinds; the Jornado del Muerto, with its hundred whirlwinds; the saguara desert of Sonora, where for hundreds of miles grows no blade of grass.

The clouds are the most wonderful manifestations of the desert heavens. The forms of vaporous atmosphere are numerous. In the morning they fill the valleys with snow white vapor, which at midday rises and gathers into solitary fluffs sailing majestically along. Sometimes showers freshen the desert. These are occasionally of sufficient volume to dampen the earth and vegetation, and an awakening of life ensues which is most remarkable. Vegetation seems to awaken instantaneously, plants which before were dry and dust-covered unfold into broad areas of vivid green. Coriaceous ferns, ordinarily lying like dead leaves among the stones, unroll and wave their fronds in the freshened air. From the inconspicuous flowers of the many thorny shrubs of the acacia and yucca tribe the air is laden with perfume. It would seem paradoxical to speak of the desert in bloom, but the human senses of sight and smell can be regaled by no more pleasant experience than the delicate odors and sweeps of color that sometimes follow an unusual rainfall.

Like a dainty pencil line drawn across the sheet of desert, the trails may be seen for miles and miles. These, originally made by the wild Comanche and Apache, lead in long tangents from water-hole to water-hole, cutting paths of deep-worn ruts. Were it not for these trails connecting the various water places the desert probably would be impassable, for the priceless water is usually concealed in spots where least suspected. These water-holes were discovered by the aborigines long before the ranchman and settler came or the army wagons and cavalry troops deepened the impress of the trails. What stories of death and pain, thirst and starvation could be told by these old trails! We know that as early as 1528 many of them existed, for in that year Cabeza de Vaca and his three shipwrecked survivors of the Narvaez expedition followed these paths from water-hole to water-hole across our southern border, and that modern commerce and migration still use these, the oldest and most stable monuments of the desert.

In the desert water is king. Without it priceless ore is but as dross, and fertile soils are worthless. Upon the desert plains many men and cattle have died for the want of a drink of water.

Like the Sahara, the Great American Desert is superficially waterless. Its plains are usually barren of surface water save for an exceptional saline lagoon. A few brooks, streams or rivers arise within its larger mountain ranges, but no water ever runs off its surface to the sea. Even the great floods of water which sometimes burst from an erratic cloud with devastating effect are rapidly swallowed up by the sands or evaporated by sun and wind. It is true that there are two long rivers comparable to the Nile of the Sahara — the Colorado and the Rio Grande — which rise in the higher forested mountainous border lands and flow into and across the deserts like great canals, without gathering contributory drainage from them, losing volume in fact from absorption and evaporation in the desert portions of their courses. These are rivers born of the mountains, however, and not of the deserts.

Upon the area of the Great American Desert the maximum rainfall is less than 15 inches per annum and does not average more than 10 inches. In places such as Death Valley and the Yuma Desert it is less than 5 inches. Deducting from this maximum of 15 inches 60 per cent of its effectiveness, due to loss through evaporation, the actual rain value is only 6 inches per annum, less than the amount falling in the two crop-growing months of May and June in the Eastern States, and less than one-half the quantity that fell in September 1901 in a single 24 hours at Galveston, Tex. To this great natural fact the desert is resigned, that within its area the land with a few exceptions, not amounting to 3 per cent, is permanently and hopelessly dry, and even the most sanguine cannot refute this fact.

Before the railways came, the Great American Desert was a most primitive region. It was inhabited by a population about as dense as that of the Sahara now, but practically in the same state of culture; and the mission bells rang over the same civilization that existed in 1528. The inhabitants practised irrigation, agriculture and architecture very much like that of the Egyptians of to-day, and constructed dwellings of unburnt brick and stone. The aborigine found sustenance on the desert, but of a kind upon which the white man could not well exist. Maize was his staple of diet. This with the tunas (fruit of the prickly pear) and the roots of various yuccaceous plants, supplemented by a few wild animals, provided an aboriginal diet pure and simple.

It was no great feat for the Spaniard who already possessed an Old-World knowledge of desert craft to amalgamate with the aborigines. He gave to them a few domestic animals (the goat and the burro, which can live where other animals starve). He also gave to them the Catholic religion and the Spanish language. For nearly 400 years the desert population made

no progress in industrial civilization beyond adopting the wooden plow and the cumbersome wheeled cart known as the *carretta*.

In Mexico the old desert cities and country estates were practically in the same status of civilization that existed in the 1st century after discovery. The cities had no commerce except by caravan; the estates were great feudal districts with their fortified *haciendas*, to which all the surrounding people were attached as fiefs. For 200 miles along either side of the international border in Mexico and our own desert country the unconquered Apache spread devastation from the Pecos to the Colorado; and the only white men there were the soldiers at scattered and lonely outposts, or "bad men" endeavoring to hide from civilization, and hardly better than the Apaches in instincts or action. Here and there in the United States at the widely dispersed water-holes were a few nomadic ranchmen who owned cattle of primitive breed for which there were no purchasers, except the army and beef contractors. Some mines there were also, but these were merely those with easily reducible ores and limited in depth by the distance which a man could dig in solid rock without machines or powder, and from which burdens could be carried on the human back. In Utah alone had the white man attained a foothold.

With the advent of the railroads the modern conquest of the desert began. It was first awakened from its centuries of lethargy by the whistle of the locomotive in the eighties. In the Great American Desert in the United States and Mexico there are now more than 9,000 miles of railway. But for the railroad the Great American Desert would to-day be as unproductive as the Sahara, and still populated, like the Sahara, by people who exist without division of labor, the use of mechanical appliances or extra-territorial commerce. The first railways to be constructed were designed merely as highways between the Atlantic and Pacific seaboards. No thought of revenue from a desert itself was anticipated. Next came a great longitudinal line following the ancient trails of the Aztec from Mexico to Santa Fé. Mining and population soon followed these trunk lines, which are now extending out even into the utmost recesses of the desert. From the Pecos in Texas to California, a distance of 1,500 miles, the route of the Southern Pacific followed a belt of country devoid of water except occasionally in the Rio Grande. Not a herd of cattle, a modern house, a farm or a mine existed along this desert stretch. Nor would they exist to-day had it not been for the construction of this railway. Now its course is marked by many prosperous embryo cities and villages.

Notwithstanding the apparent scarcity of water, one of the most remarkable features of the American Desert is that water has been secured, often in apparently impossible places, and in quantities which have made possible the existence of cities and industries. Like the deserts of the Sahara and Asia, those of America have a supply of underground water; there is hardly a desert in which the experiment has been tried where waters have not been found within 2,000 feet of the surface. Though not often sufficient for agriculture, enough has usually been found to afford a supply for cattle, railroads and mines.

Underground water has usually first been found by the railway companies. When the track was first pushed across the desert, water was brought from the rear in tank cars; but when the track was completed water was bored for in the desert itself. The engineers have had at command a mechanical appliance second only in importance to the locomotive, and one which in the desert usually goes side by side with it. This is the mechanical drill. At great expense they bored in many places. The existence of underground water beneath any particular area having once been demonstrated by the railroad company, individuals, of course, usually repeated the experiment. Three notable triumphs of the mechanical drill over nature are the flowing wells of the Salton Desert, the flowing well at Benson and a supply of 700,000 gallons a day from the deep wells on the Mesa at El Paso. Each of these supplies of water was obtained from the localities which superficially were hopelessly dry.

Several of the largest mines in the desert depend almost entirely upon the water transported on cars. The Copper Queen runs its vast smelters and machinery chiefly by water thus obtained, while the famous Sierra Mojada, of Coahuila, with its population of 5,000 people, has not a drop of water except that brought in tanks a distance of 125 miles. Yet these two mines annually return millions of profit.

But the sterile and hopeless-looking soil of the desert, when artificially watered, is apparently more fertile than where rainfall is abundant. There is no nobler spectacle than a dreary waste converted into an emerald oasis by water artificially applied, and in the desert may be seen some of the most profitable and skilful agriculture in the world. The wheat fields of Utah and Sonora, the great cotton farms of Coahuila, the alfalfa valleys of the Rio Grande and the orchards of California are all inspiring examples. The transformation made in the desert where irrigation has been possible is marvelous, and in one instance — in southern California — has resulted in the development of communities of great wealth and culture, where the ideals of perfect conditions for existence are as nearly attained as possible.

A word of caution must be written, however, against an overestimate of the agricultural capacities of the desert. It is necessary artificially to collect the precipitation over large areas, and to concentrate it upon smaller areas by impounds and canals. In this manner at least 25 acres must be set aside as unproductive catchment areas for every one that may be cultivated. All rain water that falls upon the desert or upon its neighboring mountain, if it could be protected and carefully preserved, would not irrigate 5 per cent of the great desert area. The efficiency of the rain of the Great Desert region for agricultural purposes is still further diminished owing to the season in which it falls — June to October — too late for the growing crops, the planting and growing months of spring and early summer being dry. From a practical standpoint it is doubtful if even 1 per cent of the vast area can ever be profitably tilled by irrigation. The underground water supply, too, is entirely insufficient for extensive agricultural uses, even when it is free from injurious salts; and the desert people, after every possible experiment, have long since ceased to

anticipate any material supply for irrigation from that source.

From whatever point of view the problem is approached, the sober conclusions cannot be avoided that the desert as an agricultural country has its limitations. The only apparent way in which the area of irrigable lands can be seriously increased is by the construction of reservoirs to save the run-off of the forested mountains, especially that portion of the desert adjacent to the Californian, Utah and Mexican sierras. Even when this is accomplished there will still be left a vast area of desert. Hence the agricultural produce of the desert will never be large, and this product with the exception of the fruits of southern California will contribute but little for export, and will never be sufficient to supply the needs of its own population. The Great Desert is and will continue to be a profitable market for the consumption of the fresh and preserved food products and forage of the ocean seaboards and Middle West.

Notwithstanding the scarcity of water and forage the pastoral interests of the desert are considerable. Upon the stony foothills and in the mountain cañons the scant herbage and grass supply nutritious foods for many animals, and there are numerous cattle ranches, especially in the Chihuahua province, which are profitable and thriving. Statistics are wanting and hence exact figures cannot be given, but the livestock values of the desert amount to several million dollars, exceeding the agricultural products many fold.

So far as even the present agriculture in the desert is concerned, it would not exist were it not that its products were consumed at good prices by the people engaged in mining and transportation. One good mining camp, a few acres in extent — and there are many of these — gives employment and remuneration to more people than whole countries of arid farming lands. Previous to the introduction of the railway, mining in the desert was limited to simple processes and products. Without mechanical drills and hoists only moderate depths could be reached, and limited quantities of ore taken out and treated. Consequently the deeper, larger and richer ore bodies remained untouched. Silver and gold were alone considered, and the mines which now yield over $50,000,000 annually of copper could not be touched.

On the California trail near Pearce, Ariz., for 40 years the overland pioneers built their camp-fires against a ledge of quartz. Since the railway came these rocks are being crushed for the gold they contain at one of the most complete and profitable mills in America. The huge stamps and other machines were brought from New York, Pittsburgh, Chicago and Denver; the oil for fuel to run them, from California; the food for the village of over a thousand people living in homes built of Texas lumber is all brought in from the great canning, packing and fruit-growing sections of the country.

A dozen other places in the desert, each with its modern hoists, smelters, converters and electric appliances, are producing millions of mineral wealth per annum. Not only have new mines been opened and equipped, but many of the historic old mines of Mexico, abandoned because the limit of hand mining had been reached, have been reopened with the aid of the steam-hoist and air-drill, and to-day are more productive than ever.

The Great American Desert yields annually over $100,000,000 worth of metals — chiefly silver, copper and gold. This represents at 10 per cent a productive capital of $1,000,000,000. In addition to the paying mines, as large an investment is now being made in mine development and preparation for the coming of lines of railway which are everywhere reaching out to new mining fields. There is every possible reason to expect that the mineral output of the desert will be quadrupled the next decade. Mexico's production of gold and silver has increased steadily despite the political turmoil and anarchy of recent years. It produced in 1912 gold to the value of $24,343,482, and silver valued at $44,832,332; Arizona and New Mexico produced a mineral output in 1914 valued at $78,463,191. Silver, instead of being a dead metal, is being mined with renewed activity and improved appliances. The American Great Desert yields about $8,000,000 from the United States.

The smelting interests are not the least important adjuncts of the mining industry, and each smelter gives employment to many workingmen. The American Smelting and Refining Company, with its capital of $80,000,000, has great central plants in the desert at El Paso, Aguas Calientes and Monterey. Many of the mines like Boleo, the Copper Queen, the United Verde and Greene Consolidated have their own smelting works.

Many mineral districts of the desert still lie unproductive for want of transportation. This is especially true of the great copper, gold and coal fields of the Pacific States of Mexico, while the rugged western Sierra Madre contains veins of ore awaiting transportation facilities which will furnish many new and important mines.

The total population of the Great American Desert in 1910 was about 2,750,000 people. Of this total population in the United States, 500,000 are in southern California, leaving about one person to every two square miles in the remainder of the territory. Of the remaining people in the American portion of the desert, at least four-fifths are in cities, towns and mining camps. These people in their own picturesque language are by profession "prospectors," "punchers," "nesters," "miners," "lungers," "Mexicans" and "promoters." In plainer English, mineral seekers, cattle men, irrigator-farmers, miners, health-seeking consumptives, laboring Indians who have abandoned the "blanket" caste, and men who serve as intermediaries between the latent wealth of the desert and the ready cash of the East. As a whole they are an energetic lot. In the United States they consist chiefly of two classes, the Caucasian, whose ingenious brain conceives and develops industries, and the Mexican (Indian) peasant, who does most of the manual labor. Across the line in Mexico the same conditions exist, except that the American finds a ready co-operator and companion in the higher caste of Mexican citizens. If any of our readers should still retain in his mind as a type of the desert citizen the bad man with the slouched hat, flowing mustaches and quick-acting revolver, he is at least ten years behind the times.

The aboriginal population of the Great American Desert was and is of quite a different type from that of the nomadic savage who lived

by the chase, in the forested mountains and upon the Great Plains. They were largely village dwellers, home builders and agriculturists who by the arts of pottery and weaving had risen to the cultured stage of barbarism as distinguished from savagery. It was their social arts and habits of industry which produced the highest aboriginal type in the ancient Aztec, and it is their blood (not the Spanish) which to-day constitutes the ruling spirit of Mexico. Upon the invasion of their environment, first by the Spanish and later by the Anglo-American civilization, they assumed at least a portion of these and to-day they are the people who constitute almost the sole laboring classes of the desert, being called Mexicans in the United States and peons or peasants in Mexico.

It is the intensity rather than the density of the desert population that appeals to the observer. Whatever is done is done better than elsewhere. This is a necessity of the desert condition. It will not pay in that region to trifle with inferior methods or products. In mining the best man and the best machine must be had; in farming with expensive water it is a waste to plant poor seed; if cattle are placed on the range they must be good cattle, and so on throughout the entire gamut of industry. The desert cities, if not as densely populous as those of some regions, are unique in their thrift and prosperity. They are all picturesque communities, presenting an interesting mixture of architectural, social and business conditions, busy with commerce and buoyant with hopes and prospects. Each desert city is thoroughly alive to municipal improvement and development. Electric lights and street cars, waterworks, schools, churches and public libraries abound, while many of the American towns have copied from their Mexican neighbors the picturesque plazas or ornate public parks within the central portions of the busy cities. In many of the Mexican desert cities may be seen the union of all the best of modern industrial improvement with the picturesque Spanish architectural features for which these places are noted. Steam and electricity have asserted their mastery, but have concealed their cold mechanism behind the prettily stuccoed and flower-entwined walls of the artistic Mexican type.

DESERT ANIMALS. Men are apt to think of the vast tracts of absolutely treeless arid sand as uninhabited, because they are void of the creatures known to the regions where humanity dwells. Yet these tracts are often teeming with life. On the shadowless expanse which affords no lurking-place, animals, adapting themselves to the exigencies of their life, often assume the pale tints of the sands whereon, by lying motionless, they may be overlooked by their enemies. They not only develop a protective coloring, but acquire certain other capabilities. They learn, for instance, to subsist on a minimum of water, or to store it within their bodies, some, indeed, developing an ability to live altogether without direct water-supply. Many desert animals are said to æstivate, that is, to sleep throughout the summer, as animals of cold climate hibernate by lying dormant through the winter season. The desert snail, in order to protect itself from dessication, builds up a wall of mucus, sometimes with two or three layers, across the opening of its shell to prevent evaporation of its moisture during the extremest heats. Small desert animals, like plain-dwellers, are burrowers, not only because they can thus escape the fierce rays of the sun, but also because they are so protected against their enemies. Even some serpents burrow, and these are more virulently poisonous than corresponding species of a different habit. All the desert creatures, from the snakes and lizards to the camels, are provided muscularly with the ability to shut out from their nostrils and eyes the sand that is blown by the powerful winds; and most of the insects (except the locusts) are practically wingless, so that these strong desert currents do not carry them away.

The large desert animals are swift, and their feet are adapted for the hot rocks and sand by being cushioned beneath with callous skin. The swiftness of these animals is indispensable to their preservation; for they must generally escape their pursuers by flight, since their habitat affords no hiding-places; moreover, they have to travel long distances for both food and water. Examples of this may be found in the camel and ostrich (qq.v.).

The desert is undoubtedly the refuge of certain animals which have been driven by competition from the more desirable habitations, and which, having located in arid land, have adapted themselves to their unfavorable environment. That they are the unsuccessful and outcast representatives of species living under better conditions is substantiated by the fact that they are almost always closely related to the forms in the fauna of the green, fertile lands beyond the desert; the differences usually being only the changes necessitated by difference of habitat.

DESERT IGUANA, or keeled lizard (*Dipsosaurus dorsalis*), a stout-bodied iguanid lizard of the deserts of the Mexican border of the United States, distinguished by a single row of keeled scales along the spine. It is terrestrial, lives in burrows, runs swiftly and is largely herbivorous. See IGUANA.

DESERT LAND LAW. Under the group of acts known as the Desert Land Law, any citizen of the United States 21 years of age or more or any person of such age who has declared his intention of becoming a citizen and who is a bona-fide resident of the State or Territory in which the land to be entered is located, and who has not previously exercised the right of making desert land entry, may take not to exceed 320 acres of arid land which he proposes to reclaim by conducting water thereon within four years from the date of his application. He must acquire a clear right to the use of sufficient water to irrigate and reclaim the whole of the land entered or as much of it as is susceptible of irrigation. At the time of filing his application he must pay the sum of 25 cents per acre. Each year after entry for three years he must file proof of having expended not less than $1 per acre or a total of $3 for the necessary irrigation, reclamation and cultivation of the land, in permanent improvements thereon and in the purchase of water rights. Thereafter upon proving compliance with the law as to reclamation of one-eighth of the irrigable area and the payment of $1 per acre he will receive patent for the lands. Title may be acquired in less time if the showing required by the law is made.

The Desert Land Law is the result of conditions found as the settlement of the public lands pushed westward beyond the hundredth meridian. It soon became evident that a large part of the public domain was semi-arid and that new agricultural conditions must be met by legislation.

The first attempt was by means of special legislation passed 3 March 1875 for the sale of desert lands in Lassen County, Cal., in tracts of not more than 640 acres at a price of $1.25 per acre. The land was to be reclaimed by conducting water thereon within two years. This act was a departure in two particulars from the policy of the Homestead Act enacted 13 years before and being then the principal mode of disposing of public lands, first in not requiring residence on the land, and second in allowing an individual to take four times the limit of area fixed in the homestead law.

The general Desert Land Act was passed 3 March 1877, and applied to practically all the States and Territories in which desert land is found. The principal difference from the former act was in allowing three years for reclamation instead of two.

The Act of 30 Aug. 1890 limited the amount of land which anyone could acquire under any or all the public land laws to 320 acres. The Act of 3 March 1891 provided more in detail as to the requirements of reclamation and demanded for three years the annual proof of an expenditure of $1 per acre in the reclamation of the land and in permanent improvements thereon. The entryman is also required to cultivate one-eighth of the land.

The lack of residence requirement and the ease with which the proof of expenditure could be made opened the way for much fraud under this act and the amount of land permanently improved under it is disappointingly small.

The opportunities for irrigating lands on a scale which could be handled by a small number of individuals were comparatively few and experience showed that irrigation companies which did not also own or control the land to be irrigated were seldom financially successful. Congress has not been willing to give individuals or corporations control of large areas such as was necessary for the success of the more extensive and costly irrigation enterprises. The limit of individual development was therefore soon reached and some new plan became necessary.

To meet this situation Congress provided a method of encouraging reclamation by the States under the Act of 18 Aug. 1894 known as the Carey Act, and later Congress provided for the reclamation of the arid lands by funds from the public treasury under the Act of 17 June 1902 known as the Reclamation Act. See RECLAMATION LAWS. For the soldiers' and sailors' relief acts of 1917–18, see HOMESTEAD LAWS.

MORRIS BIEN,
United States Reclamation Service.

DESERT PLANTS, such plants as are characteristic of arid regions; in general marked by structures adapted to check transpiration of water, such as reduced leaf-surface, absence of leaves, thickened epidermis, hairy or waxy coverings, stomata ("breathing apparatus") in sunken pits, the entrances to which may or may not be protected by hairs, perennial underground parts such as bulbs, tubers, rhizomes; and annual plants which flourish during the wet season, where such occurs, and, like the tops of many of the perennial herbaceous species, die during the dry season. On the other hand water-absorbing organs are often highly developed; the root-systems are not only large but the root-hairs are exceedingly numerous. Storage organs other than underground parts are common, as in many plants with fleshy leaves and in the thick stems of cacti. In regions of less and less rainfall the vegetation becomes more and more monotonous and restricted to the most resistant forms. In addition to intense heat and light, drying winds and small rainfall, the plants have often to adapt themselves to withstand salts which are brought to the surface in solution and left as the water evaporates.

Structural differences and similarities may be observed in the plants characteristic of Alpine and Arctic conditions. Another striking character of desert plants is their restriction to a limited area by isolation and by enforced adaptability to peculiar conditions, in which respects desert and Alpine plants are similar, but in which each differ from Arctic plants that have a wide range. See ALPINE PLANTS; ARCTIC REGION; BEACH PLANTS; HALOPHYTES; PLANT GEOGRAPHY; XEROPHYTES.

DESERT VARNISH, a hard dark brown coating that occurs on the surface of most rocks in desert regions. As waters circulate through the rock they gather a certain amount of mineral matter in solution. In humid regions this mineral matter is carried out in springs and removed by river waters. But in deserts all this water evaporates as soon as it gets to the surface of the rock, and the mineral matter is left behind to form the desert varnish.

DESERTAS, dā'sĕr-tàs, a group of four small rocky islands in the Atlantic Ocean, 30 miles southeast of Madeira, visited at certain seasons of the year by fishermen and herdsmen. They are named Sail Rock, the northernmost and smallest, Deserta Grande, Chao and Bugio, the southernmost.

DESERTED VILLAGE, The. 'The Deserted Village,' the best known of Oliver Goldsmith's poems, appeared in May 1770, and reached a 5th edition by August of that year. There has never been any marked diminution of the favor in which it is held by lovers of poetry, though pentameter couplets and didacticism were even in 1770 not the newest poetic fashion and were soon dispossessed. Goldsmith's couplets, less epigrammatic than Pope's and less austere than Dr. Johnson's, are easier and more natural than those of either of his masters, not because Goldsmith paid less attention to his workmanship but because he gave his measure, by means of unusual variety of pauses and a singularly limpid diction, a flowing rhythm that matches the deeper rhythm of his genuine emotion. The didactic element grew out of his wish to exhibit the harm done by those rich men who, merely to enlarge their private grounds, buy up neighboring farms or villages and drive the inhabitants out. Doubtless he was somewhat melodramatic in his plea, but the evil did exist, as it does still, and he merely used a poet's weapons against selfish

and inhumane luxury. Argument, however, is not the essential merit of the poem. Grief at finding his native village deserted and in ruins brings back to the poet, who is partly Goldsmith himself and partly a mere poetic generalization, the memory of its prosperous days. The images which rise within him — the evening sports on the green, the parsonage, the schoolhouse, the inn — are described with an exquisite fidelity, a kindly humor, a tender sympathy and an unexcelled felicity of language which, even if there had never been such an abuse as Goldsmith wrote against, would have made his poem unforgettable and universal.

CARL VAN DOREN.

DESERTER, in military affairs, a soldier or sailor who absents himself without leave with the intention not to return. An officer who absents himself without intent to return upon tendering his resignation, before that resignation has been accepted, or a soldier who enlists in the army, navy or marine corps of the United States or in a foreign army, before receiving his discharge, is considered ipso-facto to be a deserter. In the United States desertion from the army or navy in time of war is subject to a court-martial which may inflict a sentence of death. Desertion under ordinary conditions is punishable by dishonorable discharge and two and one-half years hard labor, but if done during an insurrection or similar disturbance, by five years' hard labor. The United States government offers a monetary reward for the arrest and delivery of a deserter, the sum usually ranging from $20 to $30. In every civilized country the laws against desertion are similar to those of our own land—always severe upon the man who abandons his duty, punishing him with harshest discipline, and, sometimes, death.

DESERTION, in legal terminology a word applied almost exclusively to violations of the obligation of husband and wife to live together in the state of matrimony. Desertion may be defined as the wilful termination of the marriage relation by one of the parties without lawful or reasonable cause; or the voluntary refusal to renew a suspended cohabitation, without justification either in the consent or wrongful conduct of the other. Where the party absenting himself or herself from marital community with the other has a reasonable cause for so doing the severance of relations is not a desertion. It has been held that only such misconduct as would constitute a ground for divorce will excuse either a wife or a husband who separates, and lives apart, from the other; but the justification of the act would probably be a matter to be determined on the merits of each case. The refusal of matrimonial intercourse, the parties continuing to live in the same house, would not of itself constitute desertion; this would be a breach of a single conjugal obligation only. Desertion imports a complete cessation of relations, and the abnegation of the duty of companionship and all other obligations of marriage by a refusal to live together. Where the separation is by mutual consent, and the husband makes adequate provision for the support and maintenance of the wife, desertion cannot be imputed, of course. Where husband and wife are living separate without reasonable cause, and without mutual consent, and an offer of reconciliation and the renewal of marital relations is made by one party and refused by the other, the party refusing becomes a deserter. The refusal to return must be voluntary, however. If the refusal is given under restraint or duress from a third party, the remedy is against the restrainer, either by writ of habeas corpus or by a suit for alienation. Probably only the husband could sue out the writ. At common law the remedy for desertion is a suit for the restitution of conjugal rights. A deserted husband or wife may obtain a decree requiring the deserter to return; and the decree remains in force until cohabitation is resumed. Formerly, the deserter could be imprisoned for a refusal to comply with the decree. The ecclesiastical courts in England originally had jurisdiction in such cases, which devolved on the Probate and Divorce Division of the Supreme Court of Judicature when the high courts were consolidated. Under the present English Divorce law the deserter cannot be imprisoned for the desertion; but he must pay alimony if cohabitation is not resumed and he may be imprisoned for non-payment of the alimony. The English proceeding has thus been practically assimilated to the American practice. In the United States the institution of suits for the restitution of conjugal rights has never found judicial favor. The deserted spouse was relegated to the equity jurisdiction for a proper remedy. This was usually a decree of separation, with alimony to the wife if guiltless, or without alimony if she was in fault. Desertion is now a ground for divorce, absolute or limited, in nearly all States of the Union (see DIVORCE). A deserted wife, of course, has authority in law to contract debts for necessaries and charge her husband with the obligation to pay. The failure of a husband, or his gross, wanton and cruel refusal or neglect, to provide a suitable maintenance for his wife, would justify the latter in separating herself from his bed and board; and the fact that the wife has been forced by such neglect to support herself, and has been able to do so, is no defense in his favor.

In nearly all of the States the desertion and non-support of wives and dependent children by the husbands and fathers is now actionable criminally in a quarter sessions court, a police court, or in the Domestic Relations Court, which is a branch of almost every one of the municipal courts recently established in the greater cities. The process is summary, sometimes on relation of the overseer of the poor, sometimes on petition of the deserted wife. The husband being shown to have separated himself from his wife and children, or to have neglected to support them, will be required to pay a suitable sum weekly for their maintenance. Failing to do so the delinquent may be sentenced to imprisonment at hard labor. This provision for imprisonment at hard labor makes desertion and non-support an extraditable offense. Formerly it was easy for a deserting husband to evade the requirement to pay a stipend to the cast-off wife by simply going into an adjoining State to live. A deserted wife for the same reason, namely, the huband's absenteeism, found it difficult to cite the deserter into the courts of her domicile. The process of the State courts does not run beyond the State's boundaries;

but, armed with a requisition of extradition issued by their governor, the police officers of any State can now take a fugitive wife deserter from any other State to which he has fled or may flee. A propertyless husband in prison, of course, cannot comply with the order to pay maintenance. In some States, therefore, the law permits the delinquent to be committed into the custody of a probation officer, who is charged with the duty to see that the order to support the wife is complied with, and the stipend is regularly paid. An alternative method to insure payment is to require the institution wherein the delinquent is imprisoned to pay a stated sum *per diem* to a person designated by the court as the proper recipient. The *per diem* is written off as part of the running expense of the penal institution and is charged to the county. In the last analysis, however, it comes out of the labor of the prisoner breaking stones, digging ditches or building roads. The deserter is thus made to earn bread for his abandoned dependents by the sweat of his brow. The legislation on this subject, the more drastic parts of which have gone into effect during the past five or six years, provides the means whereby women in the humbler walks of life can obtain expeditiously and inexpensively the equivalent of a judicial separation with alimony.

STEPHEN PFEIL.

DESFONTAINES, dā-fôn-tān', **Pierre François Guyot, Abbé,** French writer: b. Rouen 1685; d. Paris 1745. He was one of those known to us more for their controversies with Voltaire, and his biting attacks, than from their own productions. Voltaire, by the superiority of his wit, succeeded in gaining many to his opinions; but impartial judges have long agreed that he was not altogether correct, and that the criticisms of the Abbé Desfontaines, though severe, are by no means unjust. One of the works of the abbé, which had the misfortune to excite the particular displeasure of the poet, was the well-known 'Dictionnaire néologique,' of which the sixth edition appeared in 1750 and which was intended to guard the purity of the French language, as the great writers of the 17th century had formed it; and in this respect it has certainly proved of much service.

DESFUL, dēs'fool, or **DIZFUL,** dēz'fool, Persia, city in the province of Khuzistan, its chief commercial centre, 30 miles northwest of Shuster. It is on the Diz or Coprates River here crossed by a stone bridge of 20 arches. Pop. 30,000.

DESGOFFE, dā-gôf', **Blaise Alexandre,** French painter: b. Paris, 17 Jan. 1830; d. 1901. He is famous for having imitated jewels and trinkets with pastes, and transparent coats of color. Among his works are 'Oriental Agate Cup of the 16th Century,' after the original in the collection of jewels in the Louvre; 'Oriental Vase on Enameled Pedestal of the 16th Century'; 'Amethyst Vase of 16th Century' (Luxembourg); 'Onyx Jug'; 'Money Bag of Henri II, Enamels of Jean Limonsiu' (Luxembourg); and many fruit and flower pieces. In the Corcoran Gallery, Washington, are his 'Souvenirs of the 16th and 17th Centuries.' He is also represented in the Metropolitan Museum, New York; the Walters Gallery, Baltimore; the Brooklyn Museum and many private collections in America.

DESHOULIÈRES, dā-zoo'lē-ār', **Madame Antoinette de Ligier de la Garde,** French poet: b. Paris, 1 Jan. 1638; d. there, 17 Feb. 1691. During the war of the Fronde she followed her husband into exile at Brussels, and he rescued her after she had been for eight months imprisoned at Vilvoorden as a suspicious personage. She was called the 10th Muse and the French Calliope on account of her idyls 'Les moutons' and 'Les fleurs.' Her subsequent failure in writing tragedy caused this advice to be given her: "*Retournez à vos moutons.*" Voltaire was of opinion that of all the French poets of her sex she had the greatest merit. Several learned societies elected her a member, and her agreeable manner, her animation and wit, which sometimes, but rarely, gave way to a gentle melancholy, made her the centre of attraction in the best societies at that period. A good edition of her works appeared in 1749.

DESICCATION, the evaporation or drying off of the aqueous portion of bodies. It is practised with fruit, meat, milk, vegetable extracts and many other matters. It is usually done by a current of heated dry air, and as such may be considered as distinguished from evaporators, so called, to which furnace heat or steam heat is applied. See FOOD PRESERVATION.

DESIDERIO DA SETTIGNANO, dā-sē-dā'rē-ō dä sĕt-tēn-yä'nō, **Di Bartolommeo Di Francesco,** Florentine sculptor: b. 1428; d. 1476. He was a pupil of Donatello. His chief works are the tomb of Carlo Marsuppini, chancellor of the Florentine republic, in the church of Santa Croce; and the great marble tabernacle of the Annunciation in San Lorenzo. Another church in Florence possesses a statuette of the Infant Jesus by this sculptor, of which there is a replica in the Louvre. The genuineness of many busts attributed to him has of late been disputed. The Paris and Vienna museums possess some fine examples of these.

DESIDERIUS, Lombard King. See DIDIER.

DESIGN, in painting, the first plan of a large work, drawn roughly, and on a small scale, with the intention of being executed and finished in large. See DRAWING.

In music, design means the invention and execution of the subject in all its parts, agreeably to the general order of the whole, especially in the composition of works of classical formulæ as required by a sonata or symphony

In manufactures, design expresses the figures with which the workman enriches his stuff or silk, and which he copies after his own drawing, or the sketches of some artist.

In architecture, a plan of an edifice as specified by the ground-plans, elevations, sections and any other outlines necessary to guide its construction.

DESIGN, Schools of, schools in which art is taught with an industrial application in view rather than a purely æsthetic end. Theoretically such schools may be considered as intermediate between schools of technology, in which (with the exception of the architectural courses) de-

signing is of a purely mechanical nature and application, and schools for the training of artists; yet in actual practice this distinction is not always followed. The best results in applied art are produced by foundation work similar to that essential in preparation for a distinctively æsthetic career. The courses in such schools vary in detail but generally include most of the following branches: free-hand drawing; the theoretical principles of decoration, and the history of art — especially in its decorative aspects; copying and variation of designs; original designing for textile fabrics, wall-paper, stained-glass, pottery, leather-work, book-covers, etc.; and the study of the best examples of designing — for which accessible museum collections are essential. To this is added instruction in technical manipulation.

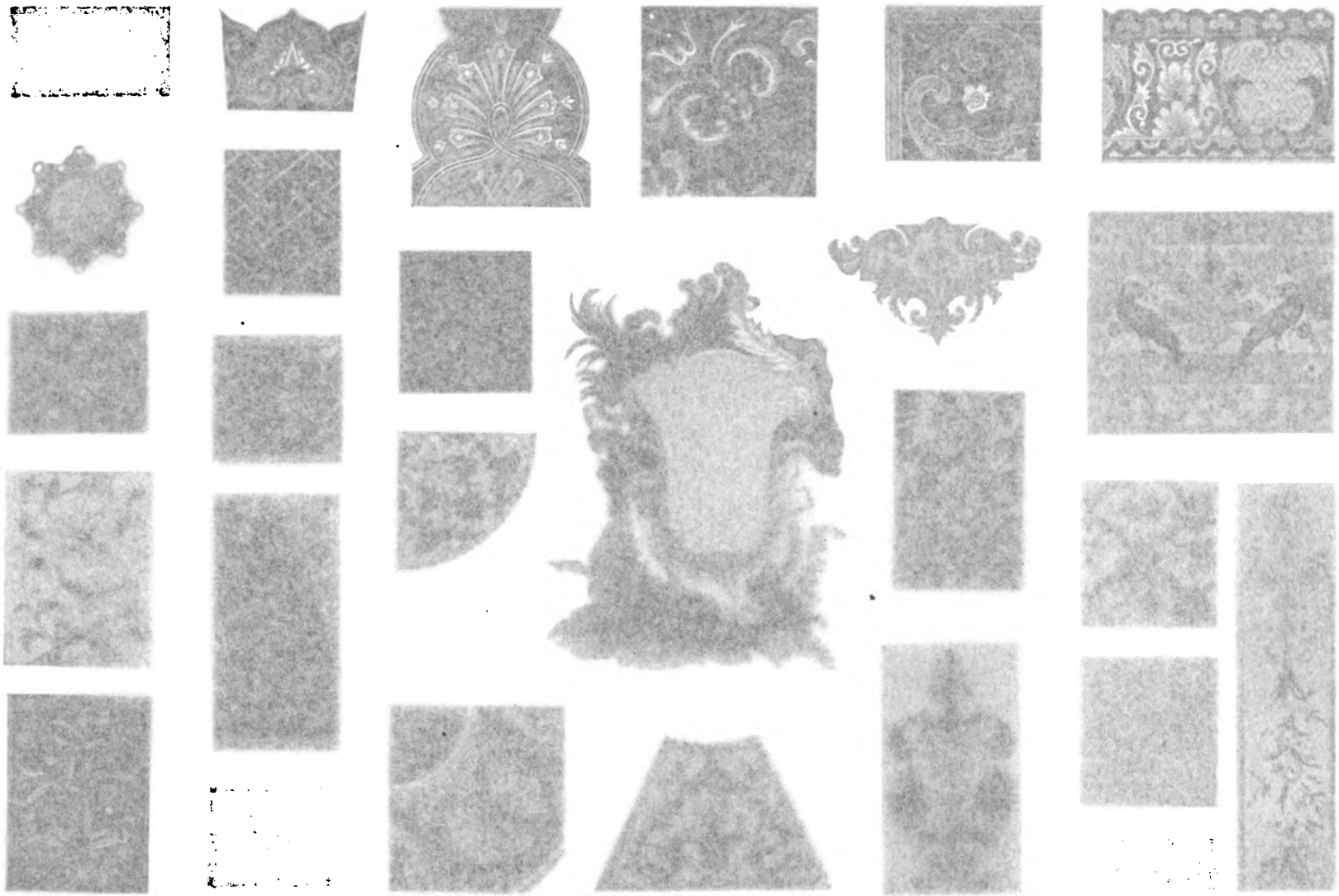
The definite endeavor to promote art education with the purpose of developing and improving the art industries of the nation had its rise in England as a result of the first international exhibition, that of 1851, at Hyde Park, London. In the United States a similar movement originated in Boston in 1870, and was an outcome of the former. The related branches of industrial art drawing and manual training owed much to the impetus given by the Centennial Exhibition of 1876. The new spirit was felt by the public schools and wrought marked changes in them during the next quarter of a century, and museums of art were created and developed. Among the institutions offering courses in applied art in the United States, may be mentioned the schools of Cooper Union; the Lowell Free School of Industrial Design (1872), affiliated with the Massachusetts Institute of Technology; the School of Design for Women in Philadelphia; the School of Design of the University of Cincinnati; and the University of Minnesota, which has a four years' course in drawing and industrial art. The large cities of Europe were provided with facilities for teaching industrial art long before such a necessity was apparent in Great Britain and the United States. In Paris the École Nationale et Spéciale des Arts Décoratifs, in Berlin the Bau Akademie and in Vienna the Imperial Art Institute, may be especially noted. The great schools devoted to the training of artists created the atmosphere and impulse without which the more practical schools would be impossible, but they hardly come within the scope of this review. Among the results produced in Great Britain by the recognition in 1851, of the superiority of France in the arts of applied design, was the creation of the South Kensington schools and Museum of Art, which have been powerful factors in effecting the great change in that nation. Consult Münsterberg, 'The Principles of Art Education' (New York 1904); and Adams, 'Theory and Practice in Designing' (New York 1911).

DESIRADE, dā-zē-rād', an island of the West Indies, dependency of Guadeloupe, from which it lies about nine miles to the east. Since 1814 it has been a French possession. It has an area of 10 square miles, and a population of about 1,500, composed mainly of emancipated slaves. It is known as the island which Columbus first discovered on his second voyage in 1493, and to which he gave the Spanish name **Deseada,** «desired.»

DESJARDINS dā-zhär-dăn', **Alphonse,** Canadian journalist and politician: b. Terrebonne, Quebec, 6 May 1841. He was educated at Masson and Nicolet colleges, and was admitted to the bar in 1862. In 1868 he turned his attention to journalism, was on the staff of *L'Ordre,* and later became editor-in-chief of *Le Nouveau Monde.* He assisted in organizing the Papal Zouaves sent to the aid of the Pope in 1868, and is a member of the Order of Pius IX. He was a member of the lower house of the Canadian Parliament (1878–92) and was then called to the senate. In 1893 he was mayor of Montreal and in 1896 for a short time minister of militia and then minister of public works.

DESJARDINS, Martin, gallicized name of **Martin Vanden Bogaert,** French sculptor: b. Breda 1640; d. Paris, 2 May 1694. He became a member of the Academy in 1671, professor (1681); rector (1686); and court sculptor to Louis XIV. He was a gifted sculptor, decorator and woodcarver, executing many works for the churches of Paris, the College of the Four Nations, palace of Versailles, etc. His chief work was a monument to Louis XIV (1686), removed in 1792 and destroyed save a few parts now in the Louvre and the Invalides. Another Louis XIV, an equestrian statue, remains at Lyons, with several portraits in busts and bas-reliefs at the Louvre and at Versailles.

DES KNABEN WUNDERHORN. 'The Boy's Marvelous Horn' (Vol. I, 1806, really published in 1805, II–III, 1808), the most famous collection of German folksongs, was the work of Clemens Brentano (q.v.) and Achim von Arnim (q.v.), both members of the Heidelberg Romantic group. The title was furnished by the title of the introductory poem, the theme of which suggests in symbol the content of the whole collection. Romantic mediævalism began to bear fruit in a profound and varied study of the national past, conspicuously in collections of older tales and poems and in scholarly editions of older masterpieces. German interest in folk-poetry, which was awkened soon after the middle of the 18th century largely through the stimulus of 'Percy's Reliques,' centred mainly in Herder and his followers. Herder's great collection of folk-poetry (1778–79) in accordance with his conception of the term, was cosmopolitan in scope. 'Des Knaben Wunderhorn,' on the contrary, was distinctly national, in part conceived as a witness to national treasures at a time when the political fortunes of Germany were at a low ebb. The transcription of the texts of the songs, whether from older printed sources or derived from oral tradition, is sometimes careless and linguistically inaccurate; the collectors even made deliberate alterations. Later collections have been more extensive and more scientific, but the importance of 'Des Knaben Wunderhorn' remains: it is a treasure-house of popular song and ballad, of infinite variety and beauty, an index of a people's soul. The influence of this work on the lyric poets and ballad-writers of the early 19th century can hardly be overestimated, notably on Uhland, Eichendorff, Wilhelm Müller and Heine. The collectors dedicated the first volume to Goethe, who reviewed it favorably and significantly in the *Jenaische Allgemeine Litteratur-Zeitung* (21 and 22 June 1806). Among several editions with notes and



critical material, those of Boxberger, and of Birlinger and Crecelius may be mentioned. Consult also, Rieser, 'Des Knaben Wunderhorn und seine Quellen' (Dortmund 1908).

HARVEY W. THAYER.

DE SMEDT, Charles, Belgian ecclesiastic: b. Ghent, 6 April 1833; d. Brussels, 4 March 1911. He received his education at the College of Saint Barbara, Ghent, the College of Our Lady of Peace, Namur, the Jesuit scholasticates of Namur, Tronchiennes and Louvain. In 1851 he entered the Society of Jesus, taught several years at Tronchiennes, was ordained in 1862 and from 1864 to 1870 was professor of church history and of dogmatic theology at the scholasticate of his order in Louvain. In 1871–76 he was a member of the staff of the 'Acta Sanctorum' and from 1876 to 1911 was a member of the Bollendists at Brussels, serving also (1899–1902) as acting rector of Saint Michael's College. He made an address on 'Des devoirs des écrivains catholiques dans les controverses contemporaines,' at the Second Congress of the Catholics of Normandy at Rouen in 1885. Many other important addresses were made by him, notably that on 'Les origins du duel judiciaire,' at the International Catholic Scientific Congress at Brussels in 1894. He was a member of very many learned societies, Belgian and foreign. His works include 'Dissertationes selectæ in primam ætatem historiæ ecclesiasticæ' (1876); 'Principes de la critique historique' (1883); 'Notre vie surnaturelle' (2 vols., 1911); he collaborated also in 'Acta Sanctorum Hiberniæ' (1887); 'Catalogus codicum hagiographicorum, latinorum antiquiorum sæculo XVI' (3 vols., 1889–93); 'Bibliotheca hagiographica latina antiquæ et mediæ ætatis' (2 vols., 1901); also contributions to 'The Catholic Encyclopedia' (1910) and to various scientific and historical reviews.

DE SMET, Peter John, American Jesuit missionary to the Indians: b. Dendermonde (now Termonde), Belgium, 31 Dec. 1801; d. Saint Louis, Mo., 23 May 1873. In 1822, being yet only a scholastic in the order, he was sent by his superiors to join the Jesuit mission in the United States and at the suggestion of the government became an instructor in the Indian school at Florissant, Mo.; later (1828) he became instructor in the university newly founded at Saint Louis. After this, having been ordained priest, in 1838 he entered on his destined field of labor as missionary to the aborigines, traversing on foot or in canoes or with whatever means of conveyance was possible, the regions inhabited by the Pottawatomies, Sioux, Blackfeet, Flatheads, Pend' Oreilles and other tribes in the valleys of the Missouri, Yellowstone, Platte and Columbia and on both sides of the Rocky Mountains.

On many occasions he was a commissioner on behalf of the United States government in pacifying the redmen when, provoked to fury by the wrongs done them, they went on the war path, United States officials reporting that Father De Smet alone of the entire white race could penetrate to these cruel savages and return safe and sound. In his journeys he wandered over 180,000 miles in those wildernesses in the course of his labors of 40 years. But in the meantime he made visits to Europe repeatedly, to collect funds for support of the missions and to enlist young men for labor in the same field. His collections in Europe amounted to 1,000,000 francs.

He wrote several narratives of his experience in the western wilds, among them: 'Letters and Sketches of a Residence in the Rocky Mountains' (1843); 'Oregon Missions and Travels over the Rocky Mountains' (1847); 'Western Missions' (1863); 'New Indian Sketches' (1868).

DES MEERES UND DER LIEBE WELLEN (Waves of the Sea and of Love). Among the poetic dramas of the world so many have been marred either by inadequate verse or undramatic material that 'Des Meeres und der Liebe Wellen' (1831), by Franz Grillparzer, stands out by virtue of the harmony of its material and treatment. It is, as the Germans say, "aus einem Gusse," all of the same mold — verse, story, handling, setting — all beautiful, majestic, tender, compelling. For his theme, Grillparzer goes back, as he did in 'Sappho' and 'Das goldene Fliess' to the Greek world, taking the ageless story of Hero and Leander to illustrate the tragedy of love when it comes to those who are dedicated to the service of the gods. While Grillparzer's method has not the august simplicity or economy of the Greeks in their handling of tragedy, it has a classic strength that is rare in romantic literature. His verse, moreover, and his characterization, have a warmth and a tenderness that is partly traceable to his appreciation of the great Spanish dramatists. Nowhere in his work does his special gift show to greater advantage than in the radiant love-poetry of 'Des Meeres und der Liebe Wellen,' which fact makes it the more strange and pathetic that a public which gave his earliest and far less favored works a welcome, turned its back on this splendid achievement and on those that followed it. It was not until after Grillparzer's death that 'Des Meeres und der Liebe Wellen' was properly estimated; but to-day it is quite generally conceded to be one of the finest verse-dramas in the German language.

EDITH J. R. ISAACS.

DES MOINES, de-moin, Iowa, city, capital of the State, and county-seat of Polk County; near the geographical centre of the State, long. 16° 43′ 52″ W.; lat. 41° 35′ 45″ N. It is situated at the junction of the Des Moines and Raccoon rivers, and is entered by 19 lines of steam railroads and 4 lines of interurban electric roads, operating 203 miles of track. The city is built on a plateau 849 feet above the sea-level, is intersected by both rivers, which are spanned by eight bridges, and is 54 square miles in area. The business portion lies near the rivers and the residences are on the higher grounds beyond.

Industries.— The city is located in the heart of a rich coal mining district, the mines in the vicinity employing over 3,500 persons, and having an annual output of 3,500,000 tons. The principal industries, besides coal mining, include pork packing, structural iron, brick and tile, foundry and machine shop products, brass goods, clay products, carriages and wagons, furniture, cotton and woolen goods, cement, wall paper and proprietary medicine, shoes, caskets, art glass, aluminum ware, gloves and caps, work garments, suspenders. It is also noted

for its immense insurance interests, there being in the city 45 insurance companies. The insurance pay-roll approximates $200,000 per month. Des Moines is the greatest farm journal centre in the world. The products of Des Moines' 412 factories, employing more than 5,000 operatives, amount to more than $30,000,000. The city has a growing jobbing trade of $103,000,000 a year — an increase of 100 per cent in six years.

Banks and Publications.— There are 21 banks and trust companies in the city, with a combined capital of $3,200,000 and annual deposits of over $40,000,000. There are published in the city four daily newspapers, four weekly newspapers, and 47 other periodicals.

Public Buildings, Churches, Educational Institutions, etc.— Among the most imposing structures in the city are the State capitol, erected at a cost of $3,000,000; the Soldiers' Monument, costing $150,000, erected on the site of the old State house; capitol extension park, $2,000,000; the State Historical building, for the collection and preservation of historical records, specimens of art, science and taxidermy, frontage 260 feet, depth 90 feet, height 60 feet, cost $500,000; the county courthouse; the United States government building, containing the post-office and Federal courts; the State arsenal; the city library, containing over 50,000 volumes; two large hospitals and the city hall. There are several small libraries, five large opera houses and 32 hotels. The education of the young is provided for by 50 public schools and several high schools, the pupils being furnished with free textbooks. For higher and technical education there are Drake University (Christian), founded in 1881; Des Moines College (Baptist) (q.v.), founded in 1865; Danish Lutheran College; Highland Park Normal College (Presbyterian); Iowa College of Medicine and Surgery; one college of osteopathy and seven technical schools. The college population of the city is 6,500. A military post for cavalry was established there by Congress, the land and buildings costing $1,200,000.

Public Works.—The city has 19 public parks covering in all 970 acres of land, and the Iowa State Fair Grounds, 600 acres in extent, are also permanently located there. The streets are well laid out and paved, there being 150 miles of brick and asphalt pavement; the city is lighted by gas and electric light, the gas distributed by 100 miles of mains, and the electric current carried over 110 miles of wire; the sewage and water systems are excellent, the waste being carried off by 93 miles of brick and pipe sewers, and the water conveyed to all parts of the city through 110 miles of mains by the Holly system for general use and fire protection.

History, Government and Population.— Fort Des Moines was built in 1843 to protect the rights of the Sacs and Foxes, and around it a settlement was made in 1846 by emigrants from Ohio, Indiana, Kentucky and Missouri. In 1851 it was incorporated as the town of Fort Des Moines and in 1857 received its charter as the city of Des Moines. In 1856 it became the capital of the State by act of the legislature. The form of government before 1907 was under the general incorporation laws of the State and council of nine members elected annually and representing the seven wards into which the city is divided. In 1907 the Des Moines plan of commission government was adopted. Five commissioners elected at large direct the affairs of the city. The annual income of Des Moines is about $1,100,000, and the budget of expenditures amounts to $1,000,000, the principal items being $965,763.84 for schools, $155,875 for the fire department, $90,580.09 for street lighting and $99,968.61 for the police department. The city debt, exclusive of school debt, amounts to $2,057,028.41; property valuation $127,164,442, and tax rate 33.5 mills. Among American cities Des Moines ranks 35th in population and 17th in postage receipts.

DES MOINES COLLEGE, a coeducational institution at Des Moines, Iowa, was organized in 1865 under the name University of Des Moines. This name was afterward changed to Des Moines College in order to conform more nearly to the aim of its supporters, the Baptists of Iowa. Like most schools of the kind, it has passed through severe financial struggles and reverses. It has an invested endowment of about $100,000 and pledges sufficient to increase this sum to $200,000. It also has a beautiful campus comprising two blocks upon which are three substantial brick buildings and a good gymnasium. An additional block adjoining is set apart as an athletic field, the whole comprising about nine acres and valued, with the buildings, at $150,000. The school has four departments: college, academy, music and art. The college has steadily maintained as its aim a high class of work, and has taken rank with the best of Iowa colleges. It has 22 instructors and an average annual enrolment of 670 students.

DES MOINES PLAN OF CITY GOVERNMENT. See COMMISSION FORM OF GOVERNMENT.

DES MOINES RIVER, the largest river in Iowa; formed by the east and west forks in southwest Minnesota; flows south-southeast to the capital city, then southeast to a point about four miles below Keokuk, where it empties into the Mississippi River; estimated length, 500 miles. It drains 10,000 square miles in Iowa; flows through a region rich in agricultural and grazing grounds, bituminous coal and timber; receives the water of Raccoon, North, Middle, South and Boone rivers. In its lower course it falls rapidly and affords abundant water power for manufacturing.

DESMOND, Humphrey J., American editor: b. Ozaukee County, Wis., 14 Sept. 1858. He was educated at Milwaukee University and entered on the practice of law in 1881. In 1891–92 he was a member of the Wisconsin legislature, and subsequently became proprietor of the *Northwestern Chronicle,* Saint Paul, and the *Memphis Journal,* of Memphis, Tenn. In 1891 he drew up the compulsory education law and later the freedom of worship law, both of which were enacted. He was one of the founders of the Western Catholic Summer School and is a member of the American Historical Association. He has published 'Mooted Questions of History' (1895); 'Random Notes of a Trip to Europe' (1897); 'The Church and the Law' (1898); 'Ways of Well Doing' (1902); 'History of the Know-nothing Party' (1904); 'Larger Values' (1913). He was a collaborator

of 'The World's Best Literature' and has contributed articles to the *American Catholic Quarterly Review,* the *Century,* the *Forum, North American Review* and 'The Catholic Encyclopedia.'

DESMOULINS, Lucie Simplice Camille Benoist, French revolutionist: b. Guise, Picardy, 2 March 1760; d. Paris, 5 April 1794. He studied at the Lycée Louis-le-Grand and later took up law. In 1785 he appeared before the Parliament of Paris as an advocate, but a defect of speech made him unsuccessful in this capacity. Before the general republican movement came to a head, he published in 1788 a pamphlet called 'La philosophie au peuple français.' But on the removal of Necker, Desmoulins suddenly found himself one of the prime instigators of the revolutionary movement. Carried along by the enthusiasm of the first few weeks, he published a political pamphlet called 'La France libre,' which scored an instant and prodigious success. It was followed shortly afterward by 'Discours de la Lanterne aux Parisiens,' which gained him the nickname of "Procureur général de la Lanterne." In November 1789, there appeared his famous journal *La Revolutions de France et de Brabant.* It inflamed the hatred of the royalists and the loyalty of the republicans, and established beyond question the position of Desmoulins as one of the foremost of republican journalists. He became a strong adherent of Robespierre, with whom he had studied at college, and of Danton, the leader of the Cordeliers. In April 1792 he founded with Fréron the journal *La Tribune des patriotes,* which expired after the fourth number had been issued. He abandoned journalism for the platform for a while, but he was less influential as an orator than as a pamphleteer. He was, moreover, not an original thinker nor consistent in his political adherence. The brilliance of his philippics was always the ornament of his devotion to one or another of the great leaders of the various democratic parties, rather than the lustre of his own deeply-rooted policies. His attack on the Girondists, which he wrote at the suggestion of Robespierre, was so effective in undermining that party that he earnestly regretted having written it. He even thought that the total expulsion of the Bourbons was far too extreme a measure. He was finally alienated from the Jacobins by his opposition in *Le Vieux Cordelier,* the Dantonist paper, to the tyrannical character of the Committee of Public Safety. He advocated just trials, less drastic punishments and more liberal policies. This led to his arrest by the committee, along with Danton and others of the party; and after a semblance of a trial and a half-hearted defense by Robespierre, Desmoulins was condemned and executed. His wife met the same fate eight days later. Consult 'Œuvres de Camille Desmoulins, avec une notice biographique,' ed. by Matton (Paris 1838); Claretie, 'Camille Desmoulins, Lucile Desmoulins étude sur les Dantonistes' (Paris 1875); and Aulard, 'Les orateurs de la Législative et de la Convention' (Paris 1885–86).

DE SOLA, Abraham, Canadian rabbi: b. London, England, 18 Sept. 1825; d. New York, 5 June 1882. Under the careful supervision of his father he received a thorough Hebrew education, and having perfected himself in his general studies, he was called in 1847 to Montreal, Canada, by its Portuguese-Hebrew congregation. His scholarship and energy soon brought him to the front, and in 1848 he was appointed professor of Hebrew and Semitic literature in McGill College, Montreal. Among his more important works may be mentioned: 'The Sanatory Institutions of the Hebrews'; 'Lectures on the Mosaic Cosmogony'; and 'Scripture Zoology.' He was for many years president of the Natural History Society of Montreal.

DESOLATION LAND, or DESOLATION ISLAND, an island belonging to Chile, in the archipelago of Tierra del Fuego. It is 70 miles long and about 15 miles in breadth. The name Desolation Island is also sometimes applied to Kerguelen Land (q.v.) in the Indian Ocean.

DE SOTO, Hernando, Spanish nobleman, conqueror and explorer: b. Villanueva de la Serena (Badajoz) about 1496; d. 1542 or 1543. As a captain in 1523–24 he shared the adventures of Córdoba's fleet on the Nicaraguan coasts, but was overcome by Gil Gonzalez Dávila through treachery. Joining Francisco Pizarro in Panama with two ships, 60 men and 10 horses, to take part in the conquest of Peru, he was appointed second in command. In 1532 he was the first Spaniard who spoke with Atahualpa; going to visit the unfortunate Inca in the character of an ambassador, he continued to be well disposed toward him during his captivity. He returned to Spain in 1536, where he married in Madrid, the following year, Inés de Bobadilla, daughter of Pedrarias Davila (q.v.). Wholly misled by the first reports of the wealth of Florida, De Soto resolved to undertake the conquest of that country, which was represented to be as rich as Peru. He sold his property and devoted the proceeds to the equipment of his ships and the outfit of his men. Charles I bestowed upon him readily enough the title of governor of Florida and Cuba. At Sanlúcar he collected 950 fighting men, besides sailors. Seven large ships and three small formed the fleet, his wife and family accompanying him in the *San Cristóbal.* De Soto sailed from Sanlúcar 6 April 1538, reached Santiago de Cuba safely, and there entered upon his duties as governor of the island, but transferred his authority at that point to his wife before proceeding to Havana (August 1538). By his orders Havana harbor was fortified (see CUBA). During the stay in Cuba his command was strengthened; 1,000 well-armed men were finally got ready, and this was probably the best force which up to that time had undertaken the conquest of any part of America. The fleet sailed from Havana 12 May 1539. In Florida the Spaniards were moderately successful until they reached the province of Tascaluza, where a great host of natives attacked them. It was said that in this nine hours' fight 11,000 Indians fell, while on the Spanish side 70 were killed and nearly all (including De Soto himself) were wounded. Worn out by the long marches, which did not lead to the discovery of treasure, the soldiers plotted to abandon the enterprise. On learning of this, De Soto marched his men toward the interior, hoping to reach New Spain (Mexico)

by land, and knowing that, at any rate, his followers would not care to desert him when the ships had been left far behind. In a nocturnal battle (December 1540) the Spaniards were again severely handled. Four months later they came upon a fort surrounded with a stockade, in storming which many were killed and nearly all wounded. De Soto still led them forward, through the present Gulf States and probably as far north as Kentucky, until he contracted a fever and died — according to Garcilaso, in 1542, though Herrera says 1543. The Spanish soldiers, who had thought to leave their commander in the lurch, were in this manner finally separated from him. At first they buried him in a trench the natives had opened near a village on the bank of a great river he had discovered; but several days afterward — either fearing the hostiles would dishonor the body or suddenly realizing how they themselves might best honor it — they hollowed out the trunk of an evergreen oak, weighted the rude coffin with armor, placed the disinterred body within it and sank it by night in the deepest part of the river, which they called the Grande and we call the Mississippi.

MARRION WILCOX.

DE SOTO, dę sō'tō, Mo., mining city in Jefferson County, on the Saint Louis, Iron Mountain and Southern Railroad, about 40 miles south by west of Saint Louis, and 15 miles west of the Mississippi River. In addition to its mining interests of zinc and lead, it has a large trade in agricultural products and exports grain, flour, produce and live stock. Its industries include a flouring-mill, shoe factory and the repair shops of the railroad. The waterworks are owned by the city. Pop. about 4,900.

DESOXYBENZOIN, phenyl-benzyl-ketone, $C_6H_5.CO.CH_2C_6H_5$; obtained by the action of zinc and hydrochloric acid on chlorobenzil $C_6H_5.CO.CHl_2.C_6H_5$, or by heating monobrom-stilbene with water. It crystallizes out of alcohol in large tablets which melt at 60° C. Desoxy-benzoin can also be obtained by reducing benzoin $C_6H_5.CO.CH(OH).C_6H_5$.

DESPARD, Edward Marcus, Irish soldier: b. Queens County 1751; d. London, 21 March 1803. He served as ensign in 1766 and in 1779 played an important rôle in the engineering service of the San Juan expedition. In 1781 he was made commander of the island of Rattan and from there was transferred to the position of supervisor, with the rank of captain, of the English colony in Honduras. In consequence of complaints made against him he was recalled in 1790. This made him disaffected and he matured a plan to assassinate the king on his way to open Parliament. The conspirators were arrested and tried by special commission at Southwark 5 Feb. 1803. There being no doubt of their guilt, Despard and nine of his associates suffered death.

DESPENSER, dĕ-spĕn'sèr, **Hugh le,** English jurist: b. about 1210; d. Evesham, 4 Aug. 1265. He was justiciar of England in 1261 and during the war of the barons with Henry III joined the former. He was killed at the battle of Evesham.

DESPENSER, Hugh le, THE ELDER, EARL OF WINCHESTER: b. 1262; d. 27 Oct. 1326. He was the son of the preceding. He served with Edmund, Earl of Cornwall, in the Welsh War. Later he supported the king in Gascony. He was called to Parliament in 1295; fought at Dunbar; joined the expedition to Flanders in 1297, and was sent to negotiate a treaty of peace between Edward, the king of the Romans and the king of France. In the following year, he went as ambassador to Boniface VIII and served in the various Scotch campaigns. Though originally of the barons' party he abandoned it, doubtless for selfish reasons, in order to support Gaveston, the king's favorite. He was temporarily dismissed from the council but soon restored, and rewarded by the grateful king for his services with the gift of the castles of Devizes and Marlborough. He and his son succeeded Gaveston as the king's favorites and honors and grants were heaped on them. This incurred the hatred of the barons who, in 1321, finally secured their banishment. At the instigation of the clergy they were soon restored and once more joined forces with the king. They assisted at the trial of the monarch's great enemy, Lancaster, and became generally hated throughout the country. Queen Isabella, wife of Edward II, was driven to drastic action against her weak-willed spouse and his favorites and finally succeeded in defeating his troops at Bristol, seizing the Despensers and having the elder executed as a traitor.

DESPENSER, Hugh le, English courtier, son of the preceding: b. about 1290; d. November 1326. He was made knight on the same day as the Prince of Wales and established himself in power and financial status by marrying Eleanor of Gloucester. He served in the wars against Scotland. He deserted the baronial party for that of Edward II, and became a royal favorite. He and his father were involved in the misfortunes following the flight of King Edward from London, and were beheaded in the same year. His grandson, Henry of Norwich, was chosen by Urban VI to lead a crusade against the antipope Clement VII. Consult Tout, 'Political History of England, 1216–1377' (London 1905).

DESPÉRIERS, dā-pā-rē-ā, **Bonaventure,** French writer: b. Arnay-le-Duc about 1505; d. 1544. In 1535, he published with Dolet, his 'Commentaries on the Latin Language.' He became secretary to Margaret of Navarre in 1536. He wrote a series of 90 stories: 'Nouvelles récréations et joyeux devis' (1558). In 1537 was published his 'Cymbalum Mundi' in French, a virulent attack on the Christian religion, which was burned by the common hangman, and of which only one copy is in existence. He ended his life by suicide. Consult Frank and Chenevière, 'Lexique de la langue de Bonaventure des Périers' (Paris 1888); Chenevière, 'Bonaventure des Périers' (ib. 1886); Rübner, 'Syntaktische Studien zu Bonaventure des Périers' (Leipzig 1897).

DES PLAINES RIVER (named from a species of maple called by the French *plaine*). A river of Illinois which rises in the southeastern part of Wisconsin and flows south and southwest until it unites with the Kankakee River at Dresden, Ill., to form the Illinois River. In length the Des Plaines is about 150 miles. For some distance the river flows almost parallel with the shore line of Lake Michi-

gan. For 13 miles the waters of the Des Plaines have been made to contribute to the Chicago Drainage Canal.

DESPOBLADO, dāz-pō-blä'dō (desert), a name given in South America to barren tracts in the Andes, which are so high and cold as to be uninhabitable. It is given as a specific name to (1) a treeless, uninhabited plateau, nearly 10,000 feet above the sea, on the Bolivian and Argentine frontier; and (2) a region in Peru between the central and western Cordilleras, ranging from 14,000 to 18,000 feet above the sea-level.

DESPOT (from the Greek despotēs), originally a master, a lord; at a later period it became an honorary title which the Greek emperors gave to their sons and sons-in-law when governors of provinces. Alexis III, surnamed Angelus, toward the end of the 12th century, is said to have first introduced this title, and to have made it the first in rank after that of emperor. Thus there was a despot of the Morea, of Servia, etc. At present, despot means an absolute ruler. In a narrower sense, it conveys the idea of tyranny, since in fact the possession of absolute power and the abuse of it are two things bordering very closely on each other.

DESPOTO DAGH, dĕs-pō'tō-dāh, or RHODOPE MOUNTAINS, a mountain chain of European Turkey, extending 30 miles from the east of the main range of the Balkans to the basin of the Maritza. Its highest summit is Muss-Alla, 9,600 feet. See RHODOPE.

DESPRÉS, dā'prā', **Suzanne Isabelle,** French actress: b. Mexico 1876. She studied at the Paris conservatory and was awarded first prizes in comedy and tragedy in 1897. She married Aurelien Lugné-Poë, manager of the Théâtre l'Oeuvre. She appeared in 'Remplaçantes' at the Antoine and in 'L'Assommoir' at the Porte Saint-Martin, and in 1902 made her first appearance at the Comédie Française in 'Phèdre.' She appeared in 'Elektra' in 1910. Her greatest success has been the portrayal of Ibsen rôles. She has appeared in London and made a tour of Germany in 1906. Consult *Nouvelle Revue* (May 1902).

DESSAIX, dā'sā', **Joseph Marie,** French general: b. Thonon, Savoy, 24 Sept. 1764; d. 26 Oct. 1834. He served at the siege of Toulon, and in Italy under Bonaparte; was elected in 1798 to the council of 500, where he opposed the *coup d'état* of the 18th Brumaire. He was made a brigadier-general by Bonaparte in 1803, and, in the campaign of 1809 against Austria, a general of division, receiving from the emperor the surname of *L'intrepide,* and the title of count of the empire. He was also made governor of Amsterdam; served in the Russian campaign of 1812 when he was wounded at Borodino; in 1814 fought against the Allies in Savoy; and became commander of the National Guards at Lyons after 1830. Consult Dessaix and Folliet, 'Etude historique sur la révolution et l'empire en Savoie: Le général Dessaix — sa vie politique et militaire' (Paris 1879).

DESSALINES, dā-sá-lēn', **Jean Jacques,** emperor of Haiti: b. 1760; d. 14 Oct. 1806. He was sold as a slave and took the name of the person in whose service he remained until 1790; after that time he fought under Biasson, and still later, joined Toussaint L'Ouverture. In his struggle against General Rigaud he signalized himself as much by his cruelty as his bravery. In 1802 he surrendered to General Leclerc. But when an epidemic of yellow fever fell upon the French army and almost annihilated it, he attacked Rochambeau with an army of 30,000 blacks, thus obliging the French commander to surrender to the English, and to leave the island (1803). In 1804, when governor-general of Haiti, he issued an order for the general slaughter of the white inhabitants. In October of the same year he was proclaimed emperor and made an unsuccessful attempt to take the city of Santo Domingo in March 1805. Incurring the enmity of his own followers, he was killed in an ambuscade near Port au Prince. Consult Dubroca, 'Vie de J. J. Dessalines' (Paris 1804).

DESSAU, dĕs'sow, Germany, capital of the duchy of Anhalt, in a valley on the Mulde, on the railroad between Berlin, Köthen, and Leipzig, 65 miles southwest of Berlin. Situated in a region well-wooded and well-cultivated it has wide tree-shaded streets, a 16th century palace, containing fine collections of Dutch, Flemish and Italian masters, relics of Napoleon and Prince Leopold, the modern palaces of the ruling prince and of Princess Louise, the parliament buildings, post office, municipal theatre and the old and new town halls. In the church of Saint Mary, erected in 1512, restored in 1857, is the tomb of Prince Leopold, noteworthy for the six stone figures which guard the sarcophagus. The city has a modern water-supply system and an electric-lighting plant, several schools and gymnasia, three libraries, one of which is the property of the municipality, two museums, with priceless art collections, and monuments to Moses Mendelssohn, the philosopher, and Wilhelm Müller, the poet, both of whom were born here, as also the composer Friedrich Schneider. In the Thirty Years War, on 25 April 1626, Wallenstein won a great victory over Count Mansfield on the Elbe bridge at Dessau. Modern commercialism has taken possession of the city during the last decades. It now has thriving industries, such as sugar refining, carpet-making, paper-making, cloth weaving, machinery manufactures, railroad car works, carriage works and distilleries. Being the centre of an intensively cultivated region it has a large trade in agricultural produce, especially grain. Albert the Bear founded Dessau in the 12th century and it became a city in 1213. In 1603 it was made the capital of the Anhalt-Dessau division of the duchy. It suffered much during the campaigns of the Thirty Years' War, but recovered within the century following. Consult Würdig, 'Chronik der stadt Dessau' (Dessau 1876). Pop. 56,600.

DESSEWFFY, COUNT **Aurel,** Hungarian statesman: b. Nagy-Mihaly, county Zemblen, Hungary, 1808; d. 9 Feb. 1842. He was famous for his euridition, his knowledge of European literature and the political economy of Bentham. Early acquainted with the proceedings of the diet of which he kept a journal, after minor state appointments he achieved fame as a member when he eloquently opposed Kossuth in the sessions of 1832–36. In 1840 he was a member of the committee for the reform of the criminal law.

DESSICANTS, in medicine, substances that check secretions from mucous membranes or cause cicatrization. See ASTRINGENTS.

DESTERRO, dā-stăr'rō, **Florianopolis.** See BRAZIL.

DESTINN, Emmy, Bohemian operatic soprano: b. Prague, Bohemia, 1878. She studied under Marie Loewe-Destinn and adopted stage name Emmy Destinn in place of her real name Kittl. She secured an engagement at the Berlin Royal Opera, where her début in 1897 was so successful that she obtained a permanent engagement. She appeared as Senta in 'Der Fliegende Holländer,' upon the invitation of Cosima Wagner at Beyreuth in 1901. She created the rôle of Salome, in Strauss' opera, at Berlin and was selected to sing the part in Paris. She had a notable success in London in 'Madame Butterfly,' and as Donna Anna and Aïda 1905. She first appeared in New York in 1908, and has since been prominently identified with the Metropolitan Opera Company of that city. She is a great favorite, not only because of her splendid singing but also because of her qualities as a superb actress. Her repertoire includes over 80 operas.

DESTOUCHES, dā-toosh', **Philippe Néricault,** French dramatist: b. Tours, France, 22 Aug. 1680; d. near Melun, France, 4 July 1754. His comedy, 'Le glorieux' (1732), is a masterpiece in matter, in elaboration and in character delineation. Lessing classes that work, with its companion piece, 'Le dissipateur' (1736), as "models of the finer high comedy." Hardly inferior to these is 'Le philosophe marié' (1727), largely based on the author's own life. Consult Bürner, A., 'Destouches et ses comédies' (Albe-Royal 1906).

DESTROYERS. See ANTI-TORPEDO BOATS.

DESTROYING ANGELS. See DANITES.

DESTUTT DE TRACY, dā-stüt' dė trā'sė, **Antoine Louis Claude,** COUNT, French philosophical and metaphysical writer: b. Paris 20 July 1754; d. there, 10 March 1836. During the French Revolution he held several important posts and was in repeated peril. He represented the nobility of Bourbonnais at the States General. In 1792 he went into exile with Lafayette. On his return to France he was sentenced to imprisonment, where he remained until the downfall of Robespierre. He served as senator under Napoleon and was raised to the peerage under Louis XVIII. He wrote 'Elements d'idéologie' (1817), a development of Condillac's philosophy and in part an exposition of what then passed for economics. His 'Delineations of the Politics of the World's Nations' (1820), and prior works, received considerable notice in the United States through Jefferson, who translated the 'Commentaire sur l'esprit des lois de Montesquieu' (1806) into English and had it published in Philadelphia (1811).

DESULTORES (from desilio, "I vault"), the Latin name for vaulters or leapers, who jumped from one horse to another. The Scythian, Indian and Numidian cavalry were very expert desultores and each man brought at least two horses to the field. When one was weary he jumped with great agility upon another, which he led by his hand. The Greeks and Romans introduced the same practice in their games, races and funeral solemnities, but never, as far as we know, in war. Homer describes a vaulter of this sort, who performed his feats on four horses at once (Iliad, xv, 679); and Livy (xxiii, 29) describes a kind of Numidian cavalry in Hasdrubal's army in Spain, in which the soldiers had two horses each, and in the heat of an engagement frequently leaped, fully armed, from one to another. Ælian gives a similar account of a tribe dwelling not far from the Danube, who, on this account, were called *Amphippi.* Modern representatives of the desultores are the Russian Cossacks whose equestrian feats surpass those of the ancients.

DETACHMENT, a body of troops or part of a fleet selected from the main body for some special service.

DETAILLE, dė-tä'yė, **Jean Baptiste Edouard,** French painter: b. Paris, 5 Oct. 1848; d. 1912. He is distinguished for his treatment of battles and military subjects. He was a pupil of Meissonier. His first picture was 'Repose during Drill in Camp Saint-Maur' (1869) which was awarded a medal. He served in the War of 1870 and his studies of army life were afterward used in his paintings with great effectiveness. Among his pictures are 'Salute to the Wounded' (1877); 'Movement of Troops,' 'The Dream' (at the Luxembourg Museum); 'Defense of Champigny' (at the Metropolitan Museum); decorative paintings at the Hôtel de Ville, Paris, and 'The Panthĕon'; 'General Lassalle at Wagram' (1912). He was a member of the Legion of Honor. One of his best pictures, 'The Passing Regiment,' is in the Corcoran Art Gallery in Washington, D. C. Consult Valmy, Baysse, 'Peintres d'aujourd' hui' (Paris 1910).

DETAINER, (1) the unlawful detention of a person against his will or the wrongful detention of the property of another. The term is applied to the unlawful detention of both personal and real property. The property may have been acquired either legally or illegally, but it must be wrongfully held either as against the owner or one entitled to immediate possession. If the person wrongfully detains the property after demand made by the owner or one entitled to the immediate possession, he is deemed to have converted it, and he may be sued in trover for damages. The usual remedy for the detention of personal property is replevin, but in some jurisdictions detinet.

Where land is the subject of the controversy, the usual action is ejectment. If the original entry was legal, no action in trespass can be brought. If a tenant at will detains the property with force after the will has determined, he is deemed guilty of forcible detainer. A detainer of land is held to be forcible where the entry was unlawful and with force and retained by force illegally, or even where the entry was peaceable and lawful if the detainer was by force and against legal right.

(2) A writ instructing the keeper of a prison to continue to keep in custody a person detained there. It was superseded by 1 & 2 Vict. c. 110, §§ 1, 2.

DETECTIVE, one who searches for criminals or ferrets out crime. The work of the de-

tective is allied to that of the police, and wherever a police force exists there is some detective work to be done, though only in connection with a large police force are men regularly assigned to detective work. The police force of New York includes a body of men known as detective sergeants, who have charge of the work of looking for criminals or investigating such crimes as seem to call for their services. The United States government maintains a force, known as Secret Service men, whose principal duties consist in unearthing counterfeiters, and those who rob the mails or infringe the revenue laws. The British goverment has established in London a force of detectives known as Scotland Yard men. There are private detective establishments in all large cities, the best-known of these being the Pinkerton bureau, which has offices in several cities of the United States under the style of the Pinkerton National Detective Agency. This agency and similar bureaus make a business of supplying detectives, usually to get evidence in civil or criminal suits.

The private detective has fallen into some disrepute in the United States, owing to employment on divorce cases or other matters where there is a temptation to manufacture evidence instead of finding it. Some judges have refused to credit the testimony of such detectives unless corroborated. In many cities private detectives are obliged to take out a license before they are allowed to follow the calling. See POLICE; SECRET SERVICE.

DETENTION HOMES, State establishments provided by the juvenile court laws of the United States for the temporary care of children awaiting court decisions. They are usually located in rented private houses, some exclusively for delinquent children, but most, both for dependents and delinquents, the sexes separated, generally under the care of a husband and wife, or a matron assisted by male officers. In Syracuse, Columbus and Buffalo, rented private houses contain both detention home and juvenile court. In Philadelphia, Milwaukee and Chicago special buildings accommodate under one roof waiting rooms, detention home and court rooms. See CHILDREN'S COURTS; JUVENILE OFFENDERS.

DETERMINANTS, an important class of algebraic functions which owe their origin to the attempt to formulate the solutions of general systems of simultaneous linear equations. Such a system of the second order is

$$a_1x+b_1y=\kappa_1,\quad a_2x+b_2y=\kappa_2;$$

from which

$$x=\frac{\kappa_1b_2-\kappa_2b_1}{a_1b_2-a_2b_1},\quad y=\frac{a_1\kappa_2-a_2\kappa_1}{a_1b_2-a_2b_1}.$$

The solution of the system of the third order,

$$a_ix+b_iy+c_iz=\kappa_i,\ (i=1,\ 2,\ 3),$$

in like manner gives

$$x=\frac{\kappa_1b_2c_3+\kappa_2b_3c_1+\kappa_3b_1c_2-\kappa_2b_1c_3-\kappa_1b_3c_2-\kappa_3b_2c_1}{a_1b_2c_3+a_2b_3c_1+a_3b_1c_2-a_2b_1c_3-a_1b_3c_2-a_3b_2c_1}$$

with expressions of similar form for y and z.

The functions appearing in the numerators and denominators of the expressions for the unknowns in the above, and in similar systems of equations, are determinants. They are formed in accordance with a general principle, the first precise statement of which was based upon the recognition of the two classes of permutations, as will presently be explained.

2. It is shown in algebra (q.v.) that the number of permutations of n elements arranged in a series is $n(n-1\ldots2\cdot1\equiv n!$ Any two elements, whether adjacent or not, standing in their natural order in a permutation constitute a permanence; standing in an order the reverse of the natural, an inversion. Thus, in the permutation *deacb* the permanences are *de, ac, ab;* the inversions, *da, dc, db, ea, ec, eb, cb.*

The permutations of any set of elements are divided into two classes, viz.: the positive, in which the number of inversions is even, and the negative, in which the number is odd. When the elements are arranged in the natural order the number of inversions is zero, which is even.

3. Interchanging two adjacent elements, α and α, of a permutation changes its class. For, if $\alpha\,\alpha$ is a permanence, $\alpha\,\alpha$ is an inversion and vice versa; and the interchange either introduces or destroys an inversion. When the two elements interchanged are nonadjacent let the number of elements between them be q and represent these, in the aggregate, by Q. As in the preceding case the interchange has no effect upon the relation of α and α to the elements preceding or following $\alpha Q\alpha$. The arrangement $Q\alpha\,\alpha$ may now be obtained by interchanging α with each of the q elements of Q in turn, after which α may be moved to the first place by successive interchanges with the $q+1$ elements of $Q\alpha$. Hence, the total number of interchanges of adjacent elements involved in the transition from the order $\alpha Q\alpha$ to the order $\alpha Q\alpha$ is $2q+1$, an odd number; from which follows the important theorem: The interchange of any two elements of a permutation changes its class.

Of any complete set of permutations one-half are positive and one-half negative.

4. Assume n^2 elements arranged in a square array thus:

$$\begin{vmatrix} a_1'a_1'' \ldots a_1^{(n)} \\ a_2'a_2'' \ldots a_2^{(n)} \\ \ldots\ldots\ldots \\ a_n'a_n'' \ldots a_n^{(n)} \end{vmatrix}$$

In this array the position of any element is shown by its indices. For examples, a_5''' is in the third column and the fifth row. The diagonal through a_1', a_2'', $\ldots$ $a_n^{(n)}$ is called the principal diagonal; that through a_n', a_{n-1}, $\ldots$ $a_1^{(n)}$ the secondary diagonal; the position occupied by a_1' the leading position.

The above array, enclosed by vertical bars as shown, is used to represent the determinant of its n^2 elements. This function may now be defined.

Write down the product of the n elements on the principal diagonal, arranging them in the natural order, thus: $a_1'a_2''a_3'''\ldots a_n^{(n)}$. This is the principal term of the determinant. Now permute the subscripts of the principal term in every possible way, leaving the superscripts undisturbed. To such of the $n!$ resulting terms as involve the positive permutations of the subscripts give the plus sign; to those involving the negative permutations, the minus sign. The algebraic sum of all the terms thus obtained is the determinant represented by the given array.

Applying the process to the determinant array of the second order, there results

$$\begin{vmatrix} a_1' a_1'' \\ a_2' a_2'' \end{vmatrix} \equiv a_1' a_2'' - a_2' a_1'';$$

while that of the third order gives

$$\begin{vmatrix} a_1' a_1'' a_1''' \\ a_2' a_2'' a_2''' \\ a_3' a_3'' a_3''' \end{vmatrix} \equiv a_1' a_2'' a_3''' + a_2' a_3'' a_1''' + a_3' a_1'' a_2'' - a_3' a_2'' a_1''' - a_1' a_3'' a_2''' - a_2' a_1'' a_3'''.$$

Each term of a determinant thus contains a single element from each column and each row of its array and is, therefore, a homogeneous function of its elements.

5. The expansion of the array of the second order may be written out at a glance. The process is less obvious, but still simple, for the array of the third order. It is as follows: Beneath the square array write the first and second rows as shown in the figure. Then form the six products, each of three elements, traversed by one of the six oblique lines, applying the signs as indicated. The aggregate of terms thus obtained is the required expansion, as may readily be verified.

The reader will now do well to note how the values of the systems of unknowns x, y, and z, y, z, obtained at the outset, may be written in the notation of determinants.

No such direct methods as the above are available for the expansion of determinant arrays of higher orders, but these will be considered further on. See 13.

6. In writing determinants it is often convenient to use a double-subscript notation, the first subscript designating the row and the second the column to which the element belongs. Thus the element a_{35} stands in the third row and the fifth column. When the elements are merely symbolic it is customary to write only the principal terms between the vertical bars. In this, which is called the umbral notation, the determinant of the nth order is

$$| a_1' a_2'' \ldots a_n^{(n)} | \quad \text{or} \quad | a_{11} a_{22} \ldots a_{nn} |;$$

which are often further abridged to $| a_1^{(n)} |$ and $| a_{1,n} |$ respectively.

Thus far the economy of the notation of determinants is scarcely apparent. Specific forms of higher order have, however, been purposely avoided. It is only necessary to write out the expansion of an array of the fourth order, which includes $4! = 24$ terms each of the fourth degree, to understand the necessity of a general theory of such forms. Determinants of even the fifth and sixth orders would be, if written out in full, quite beyond manipulation; while the complete expansion of

$$| a_1' a_2'' a_3''' a_4^{IV} a_5^{V} a_6^{VI} a_7^{VII} a_8^{VIII} a_9^{IX} a_{10}^{X} a_{11}^{XI} a_{12}^{XII} |,$$

and such functions are not at all uncommon, would fill over a thousand closely printed volumes like the present! Yet, by means of the theory of determinants, such expressions are not only intelligible but manageable. The general properties of determinants will now be considered.

7. Any term of the development of $| a_1^{(n)} |$ may be written

$$\pm a_h' a_i'' a_j''' \ldots a_l^{(n)}. \qquad (a)$$

Designate by u the number of inversions in the permutation $hij \ldots l$ and by v the number of interchanges of two elements necessary to bring the given term into the form

$$\pm a_1^{(p)} a_2^{(q)} a_3^{(r)} \ldots a_n^{(t)}. \qquad (b)$$

Obviously u and v are either both even or both odd; but the permutation $pqr \ldots t$ is positive or negative, according as v is even or odd, and the term will, therefore, have the same sign whether it be determined by the permutation of the subscripts of (a) or by that of the superscripts of (b). It follows that the development of a determinant may be obtained by permuting the superscripts and writing the signs of the terms in accordance with these permutations, instead of using the subscripts as already explained. Passing from one of these methods of development to the other is equivalent to changing each column of the array into a row of the same rank and vice versa. Hence, a determinant is not altered by changing the rows into corresponding columns and the columns into corresponding rows. Any statement made with reference to the rows of every determinant must, therefore, be equally true with respect to the columns. Rows and columns are alike called lines.

8. If any two parallel lines of a determinant be interchanged the determinant will be changed only in sign. For, interchanging two lines is the same as interchanging, in each term of the expansion, the indices corresponding to these lines. This reverses the sign of each term and therefore that of the whole determinant.

The element $a_\kappa^{(s)}$ may be transferred to the leading position by interchanging the κth row with the $(\kappa - 1)$ preceding rows and the sth column with the $(s-1)$ preceding columns. This being done, the resulting determinant must take the sign factor $(-1)^{\kappa+s}$.

A determinant having two parallel lines identical is equal to zero; for the interchange of these identical lines reverses the sign without altering the value of the function.

9. A determinant having a line of elements each the sum of two or more quantities can be expressed as a sum of two or more determinants. Let

$$\Delta \equiv \begin{vmatrix} a_1(b_1 + b_1' - b_1'' \pm \ldots)c_1 \ldots \\ a_2(b_2 + b_2' - b_2'' \pm \ldots)c_2 \ldots \\ a_3(b_3 + b_3' - b_3'' \pm \ldots)c_3 \ldots \\ \ldots\ldots\ldots\ldots\ldots\ldots \end{vmatrix}$$

be such a determinant. Then, writing

$$B_i \equiv b_i + b_i' - b_i'' \pm \ldots,$$

any term of the development of Δ is of the form

$$\pm a_p B_q c_r \ldots = \pm a_p b_q c_r \ldots \pm a_p b_q' c_r \ldots \mp a_p b_q'' c_r \ldots \pm \ldots$$

The terms Δ are obtained by permuting the subscripts $p, q, r, \ldots$ of $a_p B_q c_r \ldots$. Permuting simultaneously the same subscripts in the second member and giving to each term thus obtained its appropriate sign, there results

$$|a_1 B_2 c_3 \ldots| = |a_1 b_2 c_3 \ldots| + |a_1 b_2' c_3 \ldots| - |a_1 b_2'' c_3 \ldots| \pm \ldots,$$

which proves the theorem.

10. Multiplying each element of a given line of a determinant by a given factor multiplies the determinant by that factor; for each term of the expansion contains a single element from the given line. The common factor thus appears once and only once in each term of the expansion, and the determinant is, therefore, multiplied by that factor.

In the same way it may be shown that a determinant having a line of zeros is equal to zero. It also follows that if the elements of any

line have a common ratio to the corresponding elements of any parallel line the determinant vanishes.

11. If each element of a line of a determinant be multiplied by a given factor and the product added to the corresponding element of any parallel line the value of the determinant will not be changed. This follows directly from 9 to 10. Thus

$$\begin{vmatrix} a_{11}a_{12}a_{13}\dots a_{1n} \\ \dots\dots\dots \\ a_{n1}a_{n2}a_{n3}\dots a_{nn} \end{vmatrix} = \begin{vmatrix} a_{11}a_{12}(a_{13}+ma_{11})\dots a_{1n} \\ \dots\dots\dots\dots\dots \\ a_{n1}a_{n2}(a_{n3}+ma_{n1})\dots a_{nn} \end{vmatrix}$$

12. The terms of $|\ a_1^{(n)}\ |$ which contain the element a_1' are those found in the expansion of

$$\begin{vmatrix} a_1' & 0 & 0 & \dots 0 \\ a_2'' & a_2''' & \dots & a_2^{(n)} \\ \dots & \dots & \dots & \dots \\ a_n'' & a_n''' & \dots & a_n^{(n)} \end{vmatrix}. \qquad (a)$$

For if, in forming any term, another element than a_1' be taken from the first column an element zero must be taken from the first row, and the term vanishes. It may readily be shown that the determinant (a) is equal to

$$a_1' \begin{vmatrix} a_2'' & a_2''' & \dots & a_2^{(n)} \\ \dots & \dots & \dots & \dots \\ a_n'' & a_n''' & \dots & a_n^{(n)} \end{vmatrix}, \qquad (b)$$

which is therefore the aggregate of the terms of $|\ a_1^{(n)}\ |$, $(n-1)!$ in number, which contain the element a_1'.

The determinant factor of order $(n-1)$ by which the element a_1' is multiplied in (b) is called the cofactor of that element in $|\ a_1^{(n)}\ |$. It may be obtained from the given determinant by deleting the first column and the first row.

The cofactor of any element $a_\kappa^{(s)}$ may be found in the same manner after transposing this element to the leading position. But this transposition multiplies the determinant by the sign factor $(-1)^{\kappa+s}$. Hence, to find the cofactor of $a_\kappa^{(s)}$, delete its row and its column and give the resultant determinant the

$$\begin{pmatrix}\text{positive}\\ \text{negative}\end{pmatrix} \text{ sign when } (\kappa+s) \text{ is } \begin{pmatrix}\text{even}\\ \text{odd}\end{pmatrix}.$$

The cofactor thus obtained is represented by $A_\kappa^{(s)}$, the sign factor $(-1)^{\kappa+s}$ being intrinsic. For example, the cofactors of the elements of the second row of $|\ a_1'a_2''a_3'''\ |$ are

$$A_2' \equiv -\begin{vmatrix} a_2'' & a_3''' \\ a_3'' & a_3''' \end{vmatrix},\quad A_2'' \equiv \begin{vmatrix} a_1' & a_3''' \\ a_3' & a_3''' \end{vmatrix},\quad A_2''' \equiv -\begin{vmatrix} a_1' & a_2'' \\ a_3' & a_3'' \end{vmatrix}.$$

13. The aggregates of terms containing the elements $a_\kappa', a_\kappa'', \dots a_\kappa^{(n)}$ of the determinant $|\ a_1^{(n)}\ |$ are, respectively,

$$a_\kappa'A_\kappa', a_\kappa''A_\kappa'', \dots a_\kappa^{(n)}A_\kappa^{(n)}.$$

Each of these n aggregates includes $(n-1)!$ terms of $|\ a_1^{(n)}\ |$, no one of which appears in any of the others. In all of them, then, there are $n(n-1)!$ or $n!$, different terms of the determinant, which is the whole number. Hence

$$|a_1^{(n)}| = a_\kappa'A_\kappa' + a_\kappa''A_\kappa'' + \dots + a_\kappa^{(n)}A_\kappa^{(n)} \qquad (1)$$

Similarly,

$$|a_1^{(n)}| = a_1^{(s)}A_1^{(s)} + a_2^{(s)}A_2^{(s)} + \dots + a_n^{(s)}A_n^{(s)} \qquad (2)$$

Any determinant may, by means of either (1) or (2), be resolved into determinants of an order one lower and thus, since $A_\kappa', \dots A_\kappa^{(n)}$ or $A_1^{(s)}, \dots A_n^{(s)}$ are themselves determinants, it may ultimately be expressed in terms of determinants of the third or second order, which may readily be expanded (see 5).

14. If the hth and κth rows of $|\ a_1^{(n)}\ |$ are identical the elements $a_\kappa', a_\kappa'', \dots a_\kappa^{(n)}$ in formula (1) may be replaced by $a_h'\ a_h'', \dots a_h^{(n)}$ respectively. But in this case the value of the determinant is zero. Hence, h and κ being different indices,

$$a_h'A_\kappa' + a_h''A_\kappa'' + \dots + a_h^{(n)}A_\kappa^{(n)} = 0. \qquad (3)$$

Likewise p and s being different,

$$a_1^{(p)}A_1^{(s)} + a_2^{(p)}A_2^{(s)} + \dots + a_n^{(p)}A_n^{(s)} = 0. \qquad (4)$$

15. The determinant of order $(n-1)$ obtained by depleting the κth row and the sth column of $\Delta \equiv |\ a_1^{(n)}\ |$ is called the minor of the determinant with respect to the element $a_\kappa^{(s)}$, and is written $\Delta_\kappa^{(s)}$. Obviously, by what precedes,

$$A_\kappa^{(s)} = (-1)_{\kappa+s}\cdot \Delta_\kappa^{(s)}.$$

If two rows, the hth and κth, and two columns, the pth and sth, are deleted the result is written $\Delta_{h,\kappa}^{(p,s)}$, and is called a minor of the second order. Minors of lower orders may be obtained in a similar manner and expressed by a similar notation.

Any mth minor of a given determinant and the determinant of the m^2 elements at the intersection of the rows and columns deleted in forming it are called, with respect to each other, complementary minors. The determinant may be expressed in terms of products of pairs of complementary minors, a method of expansion due to Laplace. Formulæ (1) and (2) are special cases of the method. Its general statement is somewhat complicated.

16. The principles thus far developed will now be applied to the solution of systems of simultaneous linear equations; the process which, as stated at the outset, led to the discovery and investigation of determinants. Assume the system of three equations

$$a_ix + b_iy + c_iz = \kappa_i. \quad (i=1, 2, 3.)$$

In the determinant $|\ \kappa_1b_2c_3\ |$ let the elements $\kappa_1, \kappa_2, \kappa_3$ be replaced by the equal quantities appearing in the first members of the given equations. The two determinants now in hand are equal to each other; thus

$$\begin{vmatrix} a_1x+b_1y+c_1z, & b_1, & c_1 \\ a_2x+b_2y+c_2z, & b_2, & c_2 \\ a_3x+b_3y+c_3z, & b_3, & c_3 \end{vmatrix} = \begin{vmatrix} \kappa_1b_1c_1 \\ \kappa_2b_2c_2 \\ \kappa_3b_3c_3 \end{vmatrix}.$$

But the first member of this equation may be separated into the determinants (see 9 and 10)

$$x\ |\ a_1b_2c_3\ |,\quad y\ |b_1b_2c_3\ |,\quad \text{and}\quad z\ |\ c_1b_2c_3\ |,$$

the second and third of which are, by 8, equal to zero. Hence

$$x\ |\ a_1b_2c_3\ | = |\ \kappa_1b_2c_3\ |;$$

or, explicity (see 1).

$$x = \frac{\begin{vmatrix} \kappa_1b_1c_1 \\ \kappa_2b_2c_2 \\ \kappa_3b_3c_3 \end{vmatrix}}{\begin{vmatrix} a_1b_1c_1 \\ a_2b_2c_2 \\ a_3b_3c_3 \end{vmatrix}}.$$

Similarly, by starting with the determinants $|\ a_1\kappa_2c_3\ |$ and $|\ a_1b_2\kappa_3\ |$, respectively, the values of y and z are found to be

$$y = \frac{|\ a_1\kappa_2c_3\ |}{|\ a_1b_2c_3\ |},\quad z = \frac{|\ a_1b_2\kappa_3\ |}{|\ a_1b_2c_3\ |}.$$

It will be noted that the values of the un-

knowns have for a common denominator the determinant of the coefficients of the given equation; while the numerator is, in each case, obtained from the denominator by replacing the column of coefficients of the unknown in question by the column of absolute terms. The method is applicable to linear systems of any order.

17. When the number of given equations is greater than the number of unknowns their consistency obviously depends upon some definite relation among the known elements. Let

$$a_i x + b_i y = \kappa_i \qquad (i = 1, 2, 3)$$

be such a redundant system.

Solving the first two of these equations gives (see 1)

$$x = \frac{\begin{vmatrix} \kappa_1 b_1 \\ \kappa_2 b_2 \end{vmatrix}}{\begin{vmatrix} a_1 b_1 \\ a_2 b_2 \end{vmatrix}}, \quad y = \frac{\begin{vmatrix} a_1 \kappa_1 \\ a_2 \kappa_2 \end{vmatrix}}{\begin{vmatrix} a_1 b_1 \\ a_2 b_2 \end{vmatrix}}.$$

If, now, the three equations are consistent, these values must also satisfy

$$a_3 x + b_3 y = \kappa_3;$$

whence, substituting the above values and clearing of fractions,

$$a_3 \begin{vmatrix} \kappa_1 b_1 \\ \kappa_2 b_2 \end{vmatrix} + b_3 \begin{vmatrix} a_1 \kappa_1 \\ a_2 \kappa_2 \end{vmatrix} = \kappa_3 \begin{vmatrix} a_1 b_1 \\ a_2 b_2 \end{vmatrix};$$

or, by 8, and (1)

$$a_3 \begin{vmatrix} b_1 \kappa_1 \\ b_2 \kappa_2 \end{vmatrix} - b_3 \begin{vmatrix} a_1 \kappa_1 \\ a_2 \kappa_2 \end{vmatrix} + \kappa_3 \begin{vmatrix} a_1 b_1 \\ a_2 b_2 \end{vmatrix} = \begin{vmatrix} a_1 b_1 \kappa_1 \\ a_2 b_2 \kappa_2 \\ a_3 b_3 \kappa_3 \end{vmatrix} = 0. \qquad (5)$$

The above process being generalized, it appears that the condition that n linear equations between $(n-1)$ unknowns constitute a consistent system is that the determinant of the coefficients and absolute terms be zero.

18. Consider now the homogeneous linear equations

$$a_i x + b_i y + c_i z = 0. \qquad (i = 1, 2, 3)$$

Solving these equations as in 16 gives

$$x = y = z = \frac{0}{\begin{vmatrix} a_1 b_2 c_3 \end{vmatrix}} = 0,$$

unless

$$\begin{vmatrix} a_1 b_2 c_3 \end{vmatrix} = 0; \qquad (6)$$

in which case each unknown becomes $\frac{0}{0}$, which may have any value whatever. But the given equations may be written

$$a_i \frac{x}{z} + b_i \frac{y}{z} + c_i = 0; \qquad (i = 1, 2, 3)$$

any two of which will determine the ratios $\frac{x}{z}$ and $\frac{y}{z}$. If these three equations form a consistent system in $\frac{x}{z}$ and $\frac{y}{z}$, however, the condition expressed by (6) holds good (see 17); that is to say, the given equations consistently determine the ratios $x : y : z$ only when the determinant of the coefficients vanishes. In this case, as may readily be shown

$$\begin{aligned} x : y : z &: : A_1 : B_1 : C_1 \\ &: : A_2 : B_2 : C_2 \\ &: : A_3 : B_3 : C_3 \end{aligned} \qquad (7)$$

When the determinant of the coefficients does not vanish the equations are satisfied only by the values $x = y = z = 0$. In general:

The condition that n homogeneous linear equations between n unknowns form a consistent system, for other than zero values of the unknown, is that the determinant of the coefficients be zero.

The relation expressed by (7) may also be generalized thus: In any determinant which equals zero, the cofactors of the elements of any line are proportional to the cofactors of the corresponding elements of any parallel line.

The determinants (5) and (6) are called resultants or eliminants, each being the result of eliminating the unknowns from the system of equations from which it is derived.

19. Again let there be r homogeneous linear equations involving n unknowns, r being greater than n, thus:

$$a_i' x' + a_i'' x'' + \ldots + a_i^{(n)} x^{(n)} = 0. \qquad (i = 1, 2, \ldots n_1, \ldots r).$$

The consistency of these equations requires that every determinant of the nth order, formed by selecting n rows from the array whose elements are the coefficients written in order, shall be zero. If these conditions are fulfilled the fact is expressed by writing

$$\left\| \begin{matrix} a_1' a_2' & \ldots a_n' & \ldots a_r' \\ a_1'' a_2'' & \ldots a_n'' & \ldots a_r'' \\ \cdot \cdot & \cdot \cdot \cdot & \cdot \cdot \cdot \\ a_1^{(n)} a_2^{(n)} & \ldots a_n^{(n)} & \ldots a_r^{(n)} \end{matrix} \right| = 0.$$

the change of rows into columns being purely arbitrary. The above expression is called a rectangular array or a matrix.

20. Let it be required to eliminate the unknowns from the equations

$$ax^2 + bxy + cy^2 = 0, \; ax + \beta y = 0.$$

Multiplying the second equation, first by y and then by x, there become available three equations involving the three unknowns x^2, xy, y^2, as follows:

$$\begin{aligned} ax^2 + bxy + cy^2 &= 0, \\ ax y + \beta y^2 &= 0, \\ ax^2 + \beta xy &= 0. \end{aligned}$$

The eliminant of this system, if consistent, is

$$\begin{vmatrix} abc \\ 0 a \beta \\ a \beta 0 \end{vmatrix} = 0.$$

If the given equations be inconsistent this determinant does not vanish.

This process, due to Sylvester, may readily be generalized. It is known as the dialytic method of elimination.

21. The product of two determinants may be most readily obtained as an eliminant. To this end let

$$a_{11} x_1 + a_{12} x_2 = 0, \; a_{21} x_1 + a_{22} x_2 = 0 \qquad (a)$$

be linearly transformed by substituting

$$x_1 = b_{11} w_1 + b_{21} w_2, \; x_2 = b_{12} w_1 + b_{22} w_2; \qquad (b)$$

the result being

$$\left.\begin{aligned} (a_{11} b_{11} + a_{12} b_{12}) w_1 + (a_{11} b_{21} + a_{12} b_{22}) w_2 &= 0, \\ (a_{21} b_{11} + a_{22} b_{12}) w_1 + (a_{21} b_{21} + a_{22} b_{22}) w_2 &= 0. \end{aligned}\right\} (c)$$

Now the condition that equations (c) be consistent is that the determinant

$$\begin{vmatrix} a_{11} b_{11} + a_{12} b_{12} & a_{11} b_{21} + a_{12} b_{22} \\ a_{21} b_{11} + a_{22} b_{12} & a_{21} b_{21} + a_{22} b_{22} \end{vmatrix} \qquad (d)$$

shall vanish. But they may be consistent

because equations (a) are so, in which case

$$\begin{vmatrix} a_{11}a_{12} \\ a_{n1}a_{n2} \end{vmatrix} = 0; \qquad (e)$$

or, this condition failing, and (a) thus having no solution other than $x=0=y$, (c) will still be consistent if equations (b) are so; that is, if

$$\begin{vmatrix} b_{11}b_{12} \\ b_{n1}b_{n2} \end{vmatrix} = 0. \qquad (f)$$

The vanishing of either of the determinants (e) or (f), therefore, causes (d) to vanish; from which it follows that the determinants (e) and (f) are factors of (d). The only other factor is numerical and may readily be shown, by comparing coefficients, to be unity. Hence,

$$\begin{vmatrix} a_{11}a_{12} \\ a_{n1}a_{n2} \end{vmatrix} \cdot \begin{vmatrix} b_{11}b_{12} \\ b_{n1}b_{n2} \end{vmatrix} = \begin{vmatrix} a_{11}b_{11}+a_{12}b_{12} & a_{11}b_{n1}+a_{12}b_{n2} \\ a_{n1}b_{11}+a_{n2}b_{12} & a_{n1}b_{n1}+a_{n2}b_{n2} \end{vmatrix}.$$

The same method may be applied to the formation of the product of any two determinants of the same order. The operation may be described as follows:

To form the product $|p_{1n}|$ of two determinants $|a_{1n}|$ and $|b_{1n}|$, first connect by plus signs the elements of the rows of both $|a_{1n}|$ and $|b_{1n}|$. Then place the first row of $|a_{1n}|$ upon each row of $|b_{1n}|$ in turn and let each two elements as they touch become products. This is the first row of $|p_{1n}|$. Perform the same operation upon $|b_{1n}|$ with the second row of $|a_{1n}|$ to obtain the second row of $|p_{1n}|$, etc. Any element of this product is

$$p_{s} = a_{\kappa 1}b_{s1} + a_{\kappa 2}b_{s2} \ldots + a_{\kappa n}b_{sn}. + \qquad (8)$$

The product may also be formed by columns instead of by rows as above.

22. The operation just described may be applied to form what is conventionally called the product of two rectangular arrays of the same dimensions. Let these be

$$\left.\begin{matrix} a_{11}a_{12} \\ a_{n1}a_{n2} \\ a_{s1}a_{s2} \end{matrix}\right\} \text{ and } \left\{\begin{matrix} b_{11}b_{12} \\ b_{n1}b_{n2} \\ b_{s1}b_{s2} \end{matrix}\right.$$

Forming the product by rows gives

$$\begin{vmatrix} a_{11}b_{11}+a_{12}b_{12} & a_{11}b_{21}+a_{12}b_{22} & a_{11}b_{s1}+a_{12}b_{s2} \\ a_{21}b_{11}+a_{22}b_{12} & a_{21}b_{21}+a_{22}b_{22} & a_{21}b_{s1}+a_{22}b_{s2} \\ a_{s1}b_{11}+a_{s2}b_{12} & a_{s1}b_{21}+a_{s2}b_{22} & a_{s1}b_{s1}+a_{s2}b_{s2} \end{vmatrix}$$

If this product array be interpreted as a determinant it can only be zero; for it is the product of the two determinants formed by writing a column of zeros after one of the given rectangular arrays and a column of elements arbitrarily chosen after the other. An entirely different result would have been obtained had the product been formed by columns instead of by rows.

23. The result of replacing each element of a determinant by its cofactor is called the reciprocal of the determinant. Thus the reciprocal of

$$\delta \equiv \begin{vmatrix} a_{11} \ldots a_{1n} \\ \vdots \\ a_{n1} \ldots a_{nn} \end{vmatrix} \text{ is } \Delta \equiv \begin{vmatrix} A_{11} \ldots A_{1n} \\ \vdots \\ A_{n1} \ldots A_{nn} \end{vmatrix}.$$

Multiplying and applying the formulæ (2) and (4) to the elements of the product, gives

$$\delta \cdot \Delta = \begin{vmatrix} \delta & 0 & \ldots & 0 \\ 0 & \delta & \ldots & 0 \\ \vdots & & & \\ 0 & 0 & \ldots & \delta \end{vmatrix}, \text{ of order } n;$$

whence $\delta \cdot \Delta = \delta^n$, or $\Delta = \delta^{n-1}$.

That is the reciprocal of a determinant of the nth order is equal to its $(n-1)$th power.

Reciprocal determinants are a special case of compound determinants, whose elements are minors variously derived from one or more given arrays.

24. The application of determinants to the study of geometry and pure analysis has led to the recognition and investigation of numerous special forms, some of which will be defined and their most characteristic properties stated without demonstration.

Among the more important are the forms known as symmetrical determinants. In these any two elements symmetrically placed with respect to the principal diagonal, known as conjugate elements, have the same absolute value. If $a_{K(s)} = a_{s(K)}$ the determinant is described as simply symmetrical. If $a_{K(s)} = -a_{s(K)}$, a condition which cannot apply to the elements of the principal diagonal, unless these be zero, it is said to be gauche or skew. When the diagonal elements are zeros and $a_{K(s)} = -a_{s(K)}$ the determinant is skew-symmetric. It is very easy to show that a skew-symmetric determinant of odd order is equal to zero. When of even order, however, it is equal to the square of a certain rational function of its elements known as the Pfaffian. These functions are expressed by triangular arrays; thus

$$\begin{vmatrix} o & a & n & m \\ -a & o & b & l \\ -u & -b & o & c \\ -m & -l & o & c \end{vmatrix} = (ca - nl + bm)^2 \equiv \begin{vmatrix} a & n & m \\ & b & l \\ & & c \end{vmatrix}^2.$$

The properties of Pfaffians are strikingly analogous to those of determinants.

25. Determinants all of whose elements are zeros except those of the prinicipal diagonal and the adjacent minor diagonals above and below, and in which each element of one of these minor diagonals is -1, are called continuants. They were so named by Muir because of their connection with the theory of continued fractions. If q_2 be the number of terms in the expansion of the continuant of order i, it may be shown that $q_n = q_{n-1} + q_{n-2}$; a difference equation, the solution of which is

$$q_n = \frac{(1+\sqrt{5})^{n+1} - (1-\sqrt{5})^{n+1}}{2^{n+1}\sqrt{5}}.$$

26. A determinant in which the elements of the first row are functions of a given variable, the corresponding elements of the second row the same function of another variable, etc., is called an alternant. If the functions used as elements are powers of the variables it is described as a simple alternant. Such a determinant is divisible by the difference product of its variables, the quotient being a symmetrical function of these variables. Thus

$$\begin{vmatrix} 1 & x & x^2 \\ 1 & y & y^2 \\ 1 & z & z^2 \end{vmatrix} = (y-z)(z-x)(x-y).(x+y+z).$$

27. When $y_1, y_2, \ldots y_n$ are functions, each of $x_1, x_2, \ldots, x_n$, the determinant

$$\begin{vmatrix} \frac{\partial y_1}{\partial x_1} \frac{\partial y_2}{\partial x_2} \cdots \frac{\partial y_n}{\partial x_n} \end{vmatrix} \equiv \frac{d(y_{1,n})}{d(x_{1,n})}$$

is called the Jacobian of the given functions, a name given by Sylvester. There is a complete

analogy between the Jacobian and the ordinary differential coefficient $\frac{dy}{dx}$, which Bertrand has made the basis of another definition of these functions. Thus, letting

$$\Delta_i x_1, \Delta_i x_2, \ldots, \Delta_i x_n \quad (i = 1, 2, \ldots n)$$

be n distinct sets of increments given to $x_1, x_2, \ldots, x_n$, and

$$\Delta_i y_1, \Delta_i y_2, \ldots, \Delta_i y_n, \quad (i = 1, 2, \ldots n)$$

the corresponding increments of $y_1, y_2, \ldots, y_n$ then is

$$\mathfrak{L} \left| \frac{\Delta_1 y_1 \Delta_2 y_2 \ldots \Delta_n y_n}{\Delta_1 x_1 \Delta_2 x_2 \ldots \Delta_n x_n} \right| = \frac{d(y_1, n)}{d(x_1, n)}.$$

If the functions be subjected to linear transformation the Jacobian is multiplied by a constant factor or modulus, which is the determinant of the coefficients of the transformation. The Jacobian is thus a covariant of the functions from which it is derived. See INVARIANTS AND COVARIANTS.

If the Jacobian vanishes the functions are not independent, and conversely.

28. The Jacobian of the partial differential coefficients of a function, taken with respect to its several variables, is called the Hessian of the function. The Hessian is a symmetrical determinant.

Thus, the given function being the ternary quadric,

$$w \equiv ax^2 + by^2 + cz^2 + 2fyz + 2gzx + 2hxy,$$

$$H(w) \equiv \begin{vmatrix} a & h & g \\ h & b & f \\ g & f & c \end{vmatrix};$$

a determinant, which in this instance is also known as the discriminant, for the reason that its vanishing is the condition that w be resolvable into linear factors.

Like the Jacobian the Hessian is a covariant. Both were originally called functional determinants.

29. The theory of determinants has two notable extensions which will be explained, though little more than the definition of the functions suggested can be undertaken in the present article.

Just as n^2 elements may be arranged as a square array with two sets of parallel lines, so may n^3 elements be arranged in the form of a cube so as to lie in three sets of parallel planes. These three sets of planes may be called strata, planes and sections; the last two corresponding respectively to the rows and columns of the square array lying in any given stratum. An element of such an array may be represented by $a_{\eta\kappa s}$, where η is the number of its stratum, κ of its plane, and s of its section. Then $|a_{\eta,\kappa,s}|$ represents a function known as a cubic determinant. Its principal term is $a_{111}a_{122}\ldots a_{nnn}$, and the others are obtained as follows: Permute the third suffixes and in each of the $n!$ products obtained permute the second suffixes, thus obtaining $(n!)^2$ products. Then apply to each product a sign factor which is the product of the sign factor appropriate to the permutation of the third suffixes by that appropriate to the permutation of the second. The aggregate of terms thus obtained is the cubic determinant.

The sign of the cubic-determinant is changed by the interchange of two planes or two sections; but the interchange of two strata has no effect.

There are also determinants whose arrays can be represented only in hyper-space (see HYPERSPACES), but whose elements may be defined by means of multiple suffixes as above. Such determinants are known as hyper-determinants.

30. In the array

$$\begin{vmatrix} a_{-\lambda,-\rho} & \ldots & a_{-\lambda,\sigma} & \ldots & a_{-\lambda,\sigma} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ a_{\sigma,-\rho} & \ldots & a_{\sigma,\sigma} & \ldots & a_{\sigma,\sigma} \\ \cdots & \cdots & \cdots & \cdots & \cdots \\ a_{\mu,-\rho} & \ldots & a_{\mu,\sigma} & \ldots & a_{\mu,\sigma} \end{vmatrix},$$

letting $\lambda + \mu = n = \rho + \sigma$, the given array represents a determinant of order $(n+1)$. If now n increase indefinitely, λ, μ on the one hand and ρ, σ on the other also becoming indefinitely large, while maintaining the above relation to n, the determinant may approach a definite limiting value, it may become indeterminate, or it may become infinite. Determinants of infinite order, as here defined, present certain analogies to infinite series.

History and Bibliography.— The first definite reference to determinants is to be found in a manuscript of Leibnitz, left unpublished at the time of his death. His later development of the idea is embodied in a communication to De l'Hospital (1693) in which he explains the formation of the eliminant of a system of linear equations identical in form with that discussed in 17. In his notation he used double indices, representing the element $a_{\kappa s}$ by κs or by κ_s. The next approach to the subject was made quite independently by Cramer (1750), who expounded a rule for writing out the values of the unknowns in a system of linear equations, in which he recognized the two classes of permutations as given in 2. This rule found instant favor and the development of the theory of determinants has since been almost continuous.

The first attempt at a formal exposition of the theory was made by Vandermonde (1771). His treatment of the functions as independent of their connection with the process of elimination and his recognition of several of their more fundamental properties entitles him to be ranked as the real founder of the theory. Almost simultaneously Laplace gave the method, partly anticipated by Vandermonde, of expanding determinants in terms of complementary minors. The functions were called by him "resultants," a term now used in the restricted sense explained in 18.

New applications of the functions were at once found by Lagrange (1773), principally in the domains of geometry and the theory of numbers. Their application was further extended by Gauss (1801), who used the word determinant to designate the discriminant of the ternary quadric (see 28). He also noted the significance of reciprocal determinants (see 23), and was on the verge of discovering the multiplication theorem. This theorem (see 21 and 22) was first given by Binet (1812), but its satisfactory proof is due to Cauchy.

Cauchy was the first to use the word determinant in its present sense. His memoir in the

Jour. de l'école polytechnique (1812) rounded the general theory of determinants into something like its present form. Jacobi early adopted the new calculus and greatly extended its field of usefulness. In his hands it became, not merely an indispensable system of notation, but a powerful instrument of research as well. His justly famous memoirs in 'Crelle's Journal' (1841) made the subject readily accessible and, since their publication, determinants have been freely used by mathematical writers without apology or explanation.

A new impulse was given through the study of linear transformations, in which Cayley and Sylvester led the way. The more recent developments relate mainly to special forms of determinants. Skew determinants and Pfaffians were developed by Cayley, in connection with the orthogonal transformation. He was the first writer to use the vertical bars enclosing the determinant array. Continuants were investigated by Sylvester, who also named and made much use of Jacobians and Hessians. Alternants, first recognized by Cauchy and studied by Jacobi, have been further discussed by Trudi, Nägelbach, and Garbieri. Important results relating to compound determinants were published by Schweins (1825), but these have been rediscovered and greatly extended by Sylvester, Reiss, Kronecker, and Picquet. Determinants of infinite order have been used by G. W. Hill in a memoir on the linear theory appearing in the 'Acta Math.,' Vol. VIII. Their properties have been investigated by Poincare, von Koch, and Cazzaniga. In recent years the arithmetical properties of determinants and the theory of elementary divisors have been discussed by H. J. S. Smith, Kronecker, Frobenius and Weierstrass.

Bibliography.— Muir's 'Theory of Determinants in the Historical Order of its Development' (London 1890) is the standard work on the history of the subject down to 1841. The same author has also compiled a complete bibliography of determinates down to 1900 (*Quar. Jour. of Math.*). Spottiswoode (1851) prepared the first regular treatise. Other well-known texts are those of Baltzer (Leipzig 1857); Günther (Erlangen 1875); Dostor (Paris 1877); Scott (Cambridge 1880); Muir (London 1882); Hanus (Boston 1886); Weld (New York 1893); Scott and Mathews (Cambridge 1904).

LAENAS GIFFORD WELD,
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DETERMINATE PROBLEM, a problem in geometry which admits of a limited number of solutions, an indeterminate problem admitting of an indefinite number of solutions.

DETERMINATIVE MINERALOGY. That division of the science of mineralogy (q.v.) which treats of the identification of minerals. While the occasional new or undescribed species is necessarily identified by a determination of the percentages of its various ingredients (see CHEMICAL ANALYSIS), the symmetry and geometrical constants of its crystals (see CRYSTALLOGRAPHY), and its optical and other physical properties (see PHYSICAL CRYSTALLOGRAPHY); specimens of previously described species are accurately and rapidly determined by much simpler methods, varying from sight recognition to systematic testing with the aid of tables or "schemes." Sight recognition is the result of experience in handling and testing and has no fixed order of procedure. Except for this, it is similar to the later mentioned schemes by external signs, inasmuch as it relies chiefly on lustre, color, crystals, cleavage, associates, etc., and supplements these by tests such as the color of the mark (streak) made by it upon unglazed porcelain, or its hardness as tested by a knife point. Testing at random is nearly worthless and in all cases of doubt it is better to follow the guidance of some systematic scheme in which a few simple physical or chemical tests made in definite order successively place the specimens in smaller and smaller groups until the group is so small that the differences between its members are readily recognized and it becomes possible conclusively to eliminate all but one species. There are many schemes which may be said to be chiefly of three types. (1) Schemes in which the classifying characters are the so-called "external signs" such as lustre, color, crystalline form and simple physical tests such as hardness, color of powder (streak) or specific gravity. These schemes are invaluable in the classroom, enormously lessening the time spent in looking up characters and they foster acute observation of appearance and require only simple apparatus, such as a pocket lens, streak plate and file or knife. The best known and most followed scheme of this type was prepared in 1866 by Prof. Albin Weisbach of Freiberg, and while for the great group of minerals with non-metallic lustre and white or gray streak it is not very conclusive, the minerals of metallic lustre or with colored powders (streaks) are often very rapidly determined. For instance by the Frazer-Brown modification of Weisbach's tables only three species are at once

Submetallic or non-metallic,
Red streak,
Hardness about 4 (that of fluorite).

These are easily distinguished by the shade of red of the streak and by the specific gravity. *Zincite,* orange red, *Cuprite,* brownish-red, sp. gr. 6, *Hauerite,* brownish-red, sp.gr. 4; (2) Schemes in which the so-called "blowpipe tests" such as fusibility or qualitative determination of principal constituents, or solubility in acids, are the classifying tests, while the external signs and physical tests are subordinate. These, because they are largely independent of the condition in which the mineral occurs, use only minute amounts of material, and give positive proof of the presence of the component elements, may fairly be said to be of the most general applicability. They require in addition to the simple apparatus used in the previously mentioned schemes, a blowpipe and its accompanying lamp, forceps, wire, reagents, etc. Undoubtedly the most used schemes of this type are translations and modifications of von Kobell's 'Tables for Determination of Minerals by Simple Chemical Tests,' first published in 1833 "to facilitate determination of minerals so that by simple testing with the blowpipe and in the dry way one is led quickly to a small group which includes the mineral being tested." As with the Weisbach tables, there is first a division by lustre, but thereafter the route followed is different, the next division being by

fusibility and the further subdivisions in some cases being the detection of particular elements as arsenic, sulphur, antimony, iron, etc., and in others some detail of fusion such as "magnetic after heating" or of solubility such as "effervescence." For instance, a specimen of green granular Chrysolite ($(Mg, Fe)_2SiO_4$ would be placed by the Brush-Penfield modification of the Von Kobell tables successively in the following divisions and sub-divisions:

1. Non-metallic lustre. One of several hundred.
2. Infusible. True of 150 of the non-metallic species.
3. Dissolves in HCl leaving a gelatinous residue on evaporation. Therefore one of 16 species.
4. Gives reactions for Magnesium. Therefore one of 6 species.
5. Contains no water. Therefore one of 2 species.
6. Gives reactions for iron. Therefore chrysolite.

This confirmed by color, hardness, structure, etc.

(3) Schemes in which characters determined by the polarizing microscope are used as the classifying tests, these including single or double refraction, index of refraction, birefringence, pleochroism, shape, cleavage, color, etc. Such schemes are extensively used for the determination of the minerals in fine-grained rocks and are coming into more general use for identification not only of those minerals which can be readily made thin enough to transmit light but for the so-called opaque minerals. The testing requires specially prepared sections as thin as paper, or finely crushed powder or, in some cases, polished sections, and the tests while usually easily made require for their proper understanding a considerable knowledge of crystal structure and optics. They, however, supplement admirably the blowpipe and physical tests.

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DETERMINING TENDENCY. Also called attitude, task (*Aufgabe*) and is partly synonymous with purpose in its more empirical use. Determining tendency was a term introduced by Ach and taken over into English to designate one of the wider influences which control the course of associations and so of thought and action. One ordinarily thinks of the course of thought as controlled by the closeness of the connection between the elements of which it is made up, and of these connections in turn as due to the number of times the two experiences have occurred together in the past, the recency of their appearance together, etc. Determining tendency is looked upon as a factor of wider influence, which will make some one or some one class of the possible associates more likely to appear than others which are in themselves equally strong or even stronger. Thus if one is given a series of words and asked to speak the first other word that comes to mind each word may call up a number of associates. "Water," e.g., might suggest "drink"; "H_2O," "ice," etc. If, however, one has been asked to give the chemical composition of the substances named, "H_2O" alone comes to mind; if the request was to name the use of the objects, drinking or washing or other words of that class alone will appear. The request is the determining tendency.

Determining tendencies are frequently not definite tasks, but are furnished by the knowledge of the circumstances or situation. One tips one's hat to a male friend when he is with a lady, but only speaks when he is alone. One plays one card in a given situation when one suit is trumps; another under the same circumstances when the trump is different. One strikes one note for a given position when the selection is written in one key and another when the key is different. The awareness of the companion, the knowledge of the trump or of the key constitute in each case the determining tendency.

The influence of the wider setting has recently been given wide vogue, chiefly through the work of the Würzburg school. It was noticed as a factor in the control of perception by Pillsbury in 1897, who spoke of it as "attitude" or "setting," by Watt in the control of association in 1904, who called it *Aufgabe,* was emphasized under the present name by Ach in 1905 as a factor in the control of action and thought, and by Pillsbury again as mood or attitude as one of the conditions of attention in 1906.

The importance of emphasizing the wider controls as opposed to the immediate links which alone were considered by the associationist school is obvious. Were the strength of the mechanical connections alone to be taken into account, we would have no explanation at all of the adaptability and flexibility of human thought and conduct. If one were limited to a single response to a given stimulus or to a single thought in succession to any other thought, act and thinking would alike follow unvarying courses. One's existence would be a continuous treadmill. While we still think of all the successions as made possible by earlier associations, selection of the proper one in accordance with the situation or context increases the adequacy of the thought and act.

We must look to the nervous interactions for the real explanation of these influences. The determining tendency acts only as it is accompanied by or induces activities in the neurones. In the nervous system an association has as its analogue a connection between neurone groups induced by simultaneous action at some earlier times. Any neurone group is connected with several other groups in such a way that it may excite any one of them when it is itself excited. The determining tendency decides which of these shall be aroused. When a task is set or a wider context is effective, these preliminary stimuli partially arouse larger or smaller groups of neurones. These larger groups will have elements in common with the groups that will be aroused by the other direct

stimulus. When this finds one associated group partially aroused, it will completely arouse that one, while the others associated with it will not respond sufficiently to influence consciousness. Possibly, too, the other associates may be actually inhibited, prevented from responding at all. More likely there is both a positive and a negative effect. One group of neurones connected with the stimulus is prepared to respond by partial excitation and the others are blocked or inhibited. While we speak of determining tendency as an influence of task or setting or purpose, these terms are merely descriptive of the antecedents of the act or thought, of the circumstances under which determining tendencies act. The actual cause of the selection is to be found in the preparation for action of a group of cerebral elements by an earlier stimulus.

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DETERMINISM is the doctrine that everything that exists, as well as every event that happens, is absolutely fixed and necessary in the sense that it has been made what it is by the action of some ground or cause. From this point of view there is accordingly no element of chance or contingency in the world: nothing which is could possibly have been otherwise. While this doctrine conceives of all of the parts of the world as determined, it derives its main interest and importance from its application to the sphere of mind and the thoughts, feelings, and actions of human beings. At the present day we have become accustomed to the conception of physical nature as a uniform series of events that happen in a fixed and necessary way in accordance with uniform laws. The crucial question is whether the same mode of conception is to be extended to mind and its operations, or whether the view can be justified that mind occupies a unique place in nature and is characterized by real freedom. "Most writers on the emotions and on human conduct," Spinoza tells us, "seem to be treating rather of matters outside of nature than of phenomena which follow nature's general laws. They appear to conceive man to be situated in nature as a kingdom within a kingdom, for they believe that he disturbs rather than follows nature's order, that he has absolute control over his actions and is determined solely by himself." As against such a view, Spinoza maintains the doctrine of determinism: "that nature's laws and ordinances whereby all things come to pass and are changed from one form to another are everywhere and always the same." Hence "it is impossible that man should not be a part of nature," and subject, like everything else, to nature's universal laws.

Determinism follows directly when substance and causality are employed as the ultimate principles of explanation. From the point of view of substance, the parts are viewed as determined by the nature of the whole. This whole, whether called God, or "substance," or "matter," or "energy," is conceived as the one ultimate reality, of which particular phenomena are "accidents" or "modifications." The nature of the whole being given as a fixed datum or prior term, the nature of the parts, as its modes or modifications, are therefore also fixed and determined. More frequently, however, the causal category is employed to support deterministic conclusions, either alone or in conjunction with that of substance. No part of the universe, it is argued, stands by itself: everything gets its constitution and nature through its connection with and dependence upon something other than itself. Universal causal relationship, then, implies universal dependence, necessary determination. If the principle of cause and effect is valid throughout the whole field of reality — in the mental realm as well as in the physical — determinism is the logical and inevitable consequence. The adherents of determinism have nevertheless maintained these principles with varying degrees of strictness so far as their applications to mental life are concerned. Many of those professing determinism have given to the causal principle in its application to mind a meaning which they believe guarantees a rational view of freedom. Some of these positions will be referred to below under the various headings with reference to which the subject is to be further discussed. These headings, it will be noticed, indicate different aspects and applications of the problem as already outlined, and not separate or exclusive doctrines.

(a) **Metaphysical Determinism** arrives at its conclusions from a consideration of the general nature of the world and the universal form in which events happen. The determinism of the will is simply one instance among others of the universal order and uniformity of all events. In strict monistic systems it is difficult to avoid the conclusion that the nature of the one ultimate reality is that which determines everything. This is true, as we have seen, whether that one substance is regarded as God, or as matter or energy. The opponents of determinism accordingly usually fall back upon pluralism, and emphasize the uniqueness and self-centred reality of human personality. But this position is confronted, on the other hand, with the task of accounting for the unity which experience shows actually to exist. How, if there is a plurality of completely independent individuals, is it possible to think of the whole as forming a single world — a universe? It is clear that this world must be something more than a manifold, and that human beings least of all are mere points which exclude relation to others. This antinomy is of course just one aspect of the fundamental metaphysical problem of the one and the many, and cannot receive a full discussion here. It is however obvious from what has already been said that a solution can be found only by adopting a metaphysical system that is at the same time both monistic and pluralistic: that holds fast to the unity of things and also maintains the reality and provides for the possibility of self-determination on the part of finite individuals. Such a result is not possible for materialism, or any mechanical system of metaphysics. If, however, the view can be defended that the universe exists in its ultimate form as life and consciousness, freedom can still be maintained. For life and consciousness are principles of inclusion, not of exclusion, and at the same time they leave within their unity free place and scope for individual differences. From the metaphysical point of view, the solution of the apparent contradiction between freedom and determinism depends, therefore, upon the possibility of finding logical grounds for maintain-

ing a teleological and spiritual view of the world.

(b) **Theological Determinism.**—The problem here is in principle identical with that of metaphysics, though stated in different terms and generated by a special interest. The theological doctrine is variously known as predestination, foreordination, election, etc. (qq.v.). The whole course of history, both in its physical and moral aspects, is assumed to take place in accordance with the eternal decrees or purposes of God. The crucial problem is regarding man's ability to secure his own salvation. Theological deterministsmaintain that God has "elected some to everlasting life," and that such election, as an act of free grace, is the necessary condition of salvation. Thus Jonathan Edwards, in summing up his defense of Calvinism against the Arminians, claims: "If we put these things together, it will follow that God's assistance or influence must be determining and decisive, or must be attended with a moral necessity of the event; and so that God gives virtue, holiness, and conversion to sinners, by an influence which determines the effect in such a manner that the effect will infallibly follow by a moral necessity, which is what Calvinists mean by efficacious and irresistible grace." ('On the Freedom of the Will,' Ch. XIV).

(c) **Psychological Determinism.**—Psychology has to describe and explain the conscious processes which constitute mind; and, like all the sciences, is necessarily deterministic in standpoint. From the psychological point of view every mental process without exception finds its explanation in its relation, either to some other mental content, or (as some would maintain) to accompanying neural changes in the body. An uncaused or undetermined mental event, as, e.g., an act of will which is not connected causally with other states of body or mind, is a contradiction from this point of view. Nor is the difficulty to be avoided by supposing that the volition is caused by a free act on the part of the ego, that the self intervenes to produce changes in the natural order of events at this point or that. For if the self is thus distinguished from its states, it is no longer a member of the mental series, and cannot be invoked as a cause of any particular event. To appeal to any such special agent is to abandon the scientific problem, which is to discover the causal relation of the phenomena that constitute the mental life. As Kant in the 'Critique of Pure Reason' clearly shows, there is no possibility of freedom in a phenomenal series of mental events; since, as occurrences in time, these are subject without exception to the law of cause and effect. The oft-repeated attempts of defenders of free-will to overthrow determinism while still assuming that the psychological point of view is final are as contradictory and fruitless as the analogous attempts to vindicate teleology in the physical order by supposing that at times the natural order is interrupted by a miracle. If determinism is to be avoided, there must be an advance to a new standpoint and principle of explanation. This was perceived by Kant who, in his doctrine of man as belonging to a noumenal order of reality, passes beyond the psychological and causal point of view to the idea of self-determination in accordance with ends. It is true that Kant did not regard this new category as one that is valid for knowledge, but describes it as a "postulate" of practical or moral reason. The result of his analysis, however, was to establish the fact that while the psychological or phenomenal description of mind must employ everywhere the category of cause and effect, and can therefore only issue in determinism, yet from another point of view it is equally necessary, in order to do justice to the facts of moral experience, to introduce the idea of freedom, or determination in accordance with ends.

(d) **Historical Determinism** may be a deduction from theological determinism, by simply regarding all the events of history as determined by the will of God, who makes even the "wrath of man to praise him." But what is usually known by this name is the theory according to which historical events are to be explained by referring them to natural powers and circumstances as their causes. The demand that history shall be made a science involves such an explanation of historical events by means of causes, and carries with it the assumption of determinism. To explain historically is accordingly regarded by some writers as requiring exhibition of the various causes —geographical location, climatic conditions, racial and economic rivalries, etc.— which are to be taken as determining the course of events in the period with which they are dealing. Since, however, historical events are determined by the volitions of men, the sphere of determination must be psychological, and the remarks made in the preceding paragraph will also have application here.

(e) **Ethical Determinism.**—It is because of the supposed ethical implications of Determinism that the doctrine has been most vigorously opposed. If all human actions take place, like natural occurrences, in a strictly determined way, then it seems an immediate corollary that the sense of obligation is unmeaning and the feeling of responsibility an illusion. Consequences of this character, which seem to the opponents of the doctrine to follow from it directly, are taken by them as involving the refutation of the theory of determinism. The advocates of freedom are often content with this "practical" disproof of the opposing doctrine, admitting that from the theoretical point of view it is unanswerable. Kant, e.g., bases the proof of freedom upon the demands of the moral consciousness. Without the "postulate" of freedom the fact of moral obligation would be illusory; the "ought" implies and presupposes the "can." On the other hand, the determinists as a rule are not willing to admit that it is necessary to assume freedom in the sense of indeterminism in order to give significance to moral distinctions. In the first place they point out that determinism is by no means identical with fatalism: that the causes of an action are no compelling powers outside the individual, but his own motives and character. Moreover, as H. Sidgwick has remarked: "The determinist allows that, in a sense, the 'ought' implies 'can,' that a man is only morally bound to do what is 'in his power' and that only acts from which a man 'could have abstained' are proper subjects of punishment or moral condemnation. But he explains 'can' and 'in his power' to imply only the presence

of no obstacle that may not be overcome by sufficient motive» ('Methods of Ethics,' Ch. V). The determinist is further able to show that freedom, when conceived as indeterminism or «contingency,» is not only useless as a moral postulate, but is even subversive of morality. For if «freewill» is something out of all relation to the rational organization of experience, if it is not connected with the character and motive of the individual, it is a mere accident (the «freedom of indifference,» *liberum arbitrium indifferentiæ*), and as foreign to the personality of the individual as an external fate. As Leslie Stephen has expressed this argument: «Identify free-will with the occurrence of chance, and the conception of merit becomes contradictory and repulsive. Exclude chance, and you are virtually a determinist.» It may perhaps be questioned whether to exclude chance is «virtually» to accept determinism; but one must in any event admit that the conception of «contingency,» or «freedom of indifference» is both logically and ethically indefensible.

At the present time controversies regarding freedom and determinism do not occupy the same prominent place in ethical literature as formerly. Modern ethical writers tend to avoid the question as a metaphysical problem that may be left out of account in dealing with the facts and principles of the moral life. However unsatisfactory this avoidance of the problem may be, recent ethical theorizing may be said to take as its assumption a more concrete view of the nature of mind than that afforded by atomistic psychology. It recognizes implicitly that the causal category in terms of which the discussion has hitherto been largely carried on, is inadequate to exhibit concretely the movements of history and of individual life, and that for ethics, at least, human conduct must be regarded as the process of realizing ends and purposes which are personal rather than merely natural forces. See ETHICS; ELECTION; WILL; FREEWILL; PREDESTINATION; NECESSITARIANISM; HISTORY, LOGIC OF; PSYCHOLOGY.

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DETINUE, (1) the unlawful detention of the personal property of another. (2) A common-law action, or the writ therein used, for the recovery of a chattel wrongfully detained or for the value thereof and damages. In some States it has been superseded by replevin (q.v.). The plaintiff in this action must show that he has an absolute or a special property in the chattel. If the defendant is detaining the property illegally, it is no defense that he obtained it legally. The plaintiff in this action sues for the recovery of the property itself and damages for its wrongful detention, but if the defendant has not the property in his possession, the plaintiff may sue for its value and damages for its wrongful detention. If the property was obtained illegally, demand need not be made before suit is brought. However, demand is necessary if the plaintiff sues to recover damages for detention between demand and the commencement of the suit.

DETMOLD, Germany, city, capital of Lippe, on the Werra, 50 miles southwest of Hanover. It consists of an old and a new town, the former poorly, the latter regularly built. Its principal edifice is the palace, a fine old castellated building, with a vast round donjon tower. It contains also several educational institutions and a library. The industries consist of the manufacture of cloth, especially linen; leather furniture, beer, buttons; and the quarrying of marble and gypsum. In the vicinity, on the Grotenberg, the loftiest summit of the Teutoburger Wald, a colossal statue, 45 feet high, placed on a solid circular pedestal twice that height, has been erected to the Hermann or Arminius who overthrew Varus and his legions, in the year 9 A.D. In 783 at Detmold Charlemagne defeated the Saxons. Henry II donated the town to the bishops of Paderborn in 1011, whence it descended to the Lippe family. It became a city in its own right in 1350. Pop. about 15,000.

DETONATION. Certain chemical compounds, which, on being exposed to heat or suddenly struck, explode with a loud report, owing to one or more of the constituent parts suddenly assuming the gaseous state. They often have the power of initiating explosions in more stable compounds. A mixture of equal volumes of chlorine and hydrogen exposed to direct sunlight detonates violently, forming hydrochloric acid gas. The chloride and iodide of nitrogen are very powerful detonating substances, but too unstable for practical use. For exploding charges of powder mixtures of chlorates with reducing agents such as charcoal have been employed. Fulminate of silver and of mercury detonate by slight friction, by means of heat, electricity, or sulphuric acid. The compound used in the priming of percussion-caps and fuses is the fulminate of mercury or silver (C=NO)$_2$Hg or (C=No)—Ag, respectively), collected as a precipitate when the metal, dissolved in nitric acid, is poured in warm alcohol and the precipitate formed is collected, washed and dried. The salts of triazoic acid, N_3H, are also coming into use for the purpose. See EXPLOSIVES.

DETONATORS are the devices used in firing high explosives by detonation. They consist of small cylindrical copper tubes closed at one end and charged with mercuric fulminate or a mixture of mercurial fulminate and potassium chlorate which is compressed in the bottom of the tubes. Those used for blasting in mines and quarries are also known as blasting caps and exploders. They are rated as single force, double force, triple force and so on, the charge for the single force cap being about five grains of the detonating substance, and the charges for the higher force increasing about

two grains for each grade. To fire them a piece of Brickford or "running" fuse of the desired length is inserted in the mouth of the detonator or cap and then the copper tube is bent or "crimped" securely about the sides of the fuse. The detonator is inserted in the borehole so as to come in close contact with the first cartridge or "stick" of explosive and the borehole is filled with tamping. When a flame is applied to the end of the fuse that projects from the borehole, the column of powder in the fuse takes fire, the fire travels slowly down to the charge in the detonator, causing the detonation of the dynamite.

For military mines and naval torpedoes and, to a considerable extent, for commercial blasting detonators to be fired by an electric current are employed. These are known as electric detonators. They differ from those previously described only in that the mouth of the copper cap is closed by a plug made of sulphur and ground glass, through which two copper wires, known as the "legs of the detonator," are led. Inside the cap these wires are bridged over by a very fine wire made of an alloy of iridium and platinum. Around the bridge and between it and the fulminating composition is placed a layer of mealed gun-cotton. When it is desired "to fire," the legs of the detonator are connected with a dynamo-electric machine and the current generated. As the current passes it heats the bridges to incandescence, which sets fire to the gun-cotton; this causes the fulminate to detonate, and this detonates the charge of dynamite or other high explosives. The detonators used on the Whitehead torpedoes in the United States navy contain 35 grains of mercuric fulminate, this large quantity being used to make sure that the detonator will do its share of the work in torpedo attacks on an enemy. See EXPLOSIVES.

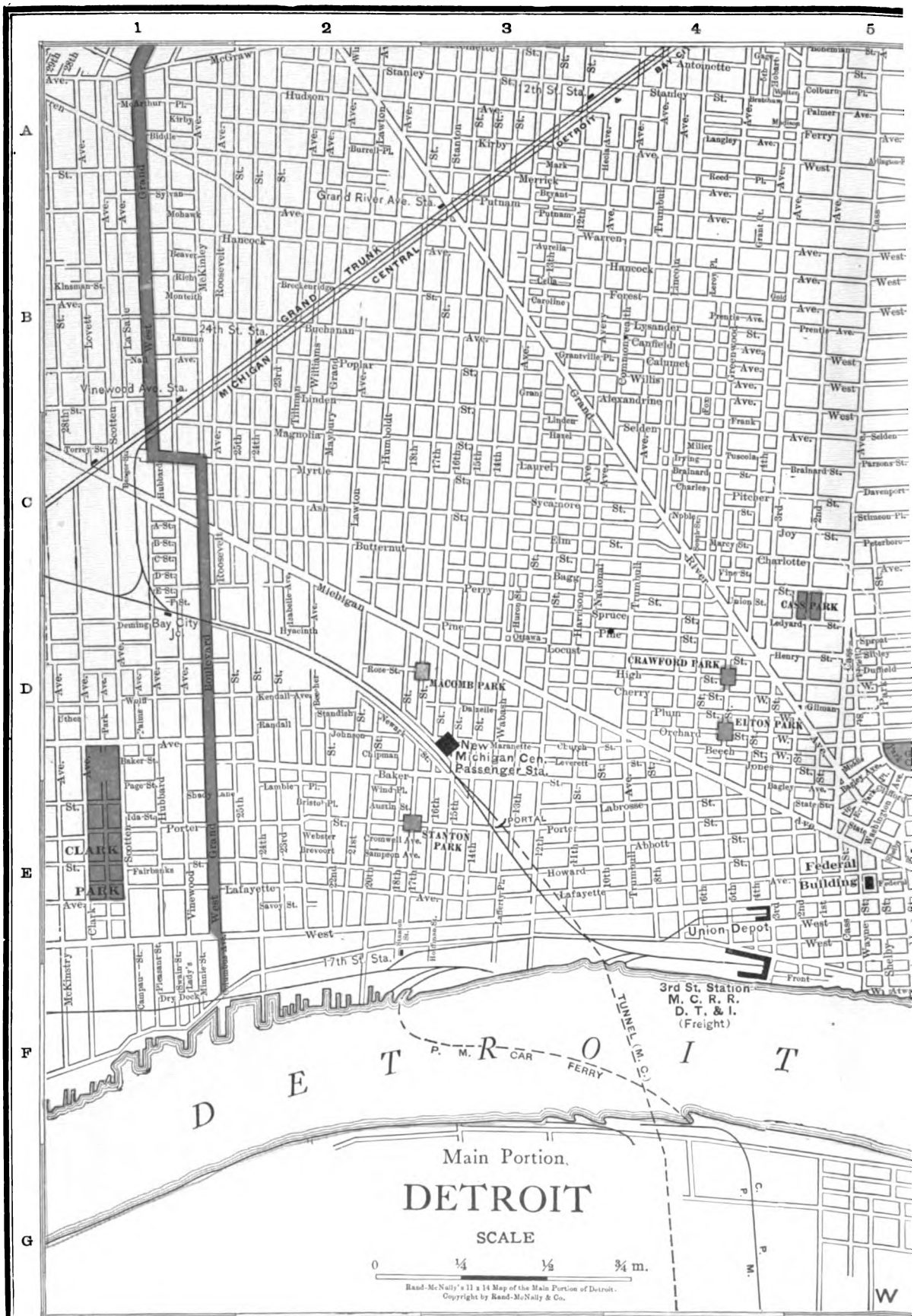
DE TREVILLE, trā'vĭl', **Yvonne,** American prima donna: b. Galveston, Tex., 25 Aug. 1881. She received her musical education from Madame Marchesi, Paris, being the youngest member of her class. She made her début in grand opera and created La Bohéme in English in New York at the age of 16. Thereafter she sang entirely abroad, appearing in the rôle of Lakmé at Opéra Comique, Paris, and at the Stockholm Royal Opera and Petrograd Symphony Concerts in 1903–04. She sang at the Cairo Khedivial Opera and the Saint Petersburg Imperial Opera 1904–05; in Bucharest, Berlin, Budapest and Nice 1905–06; in Brussels, Vienna, Munich and Trevano Castle, Switzerland 1906–07. In 1910–11 she made a concert and operatic tour of Germany, Austria, Hungary, Poland and Rumania. She sang 'Ophelia' in the gala performance of Ambroise Thomas centenary celebrations in France during the summer of 1911; and in the following winter made another operatic tour of Germany, Austria and Russia. Her repertoire covers operas in all the principal languages of Europe.

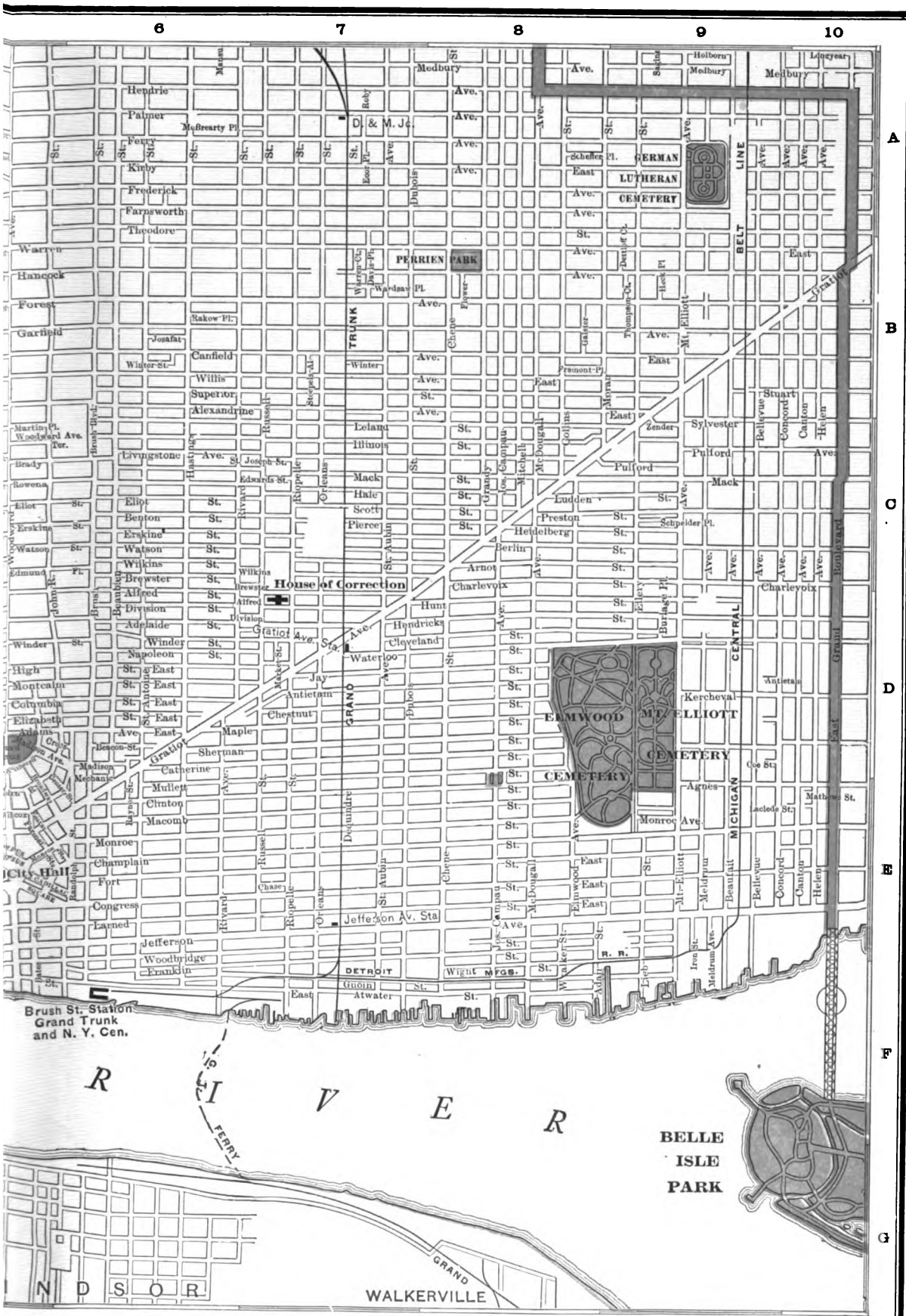
DETRITUS, applied in geology to accumulations formed by the disintegration of rocks, may consist of angular and sub-angular debris, or of more or less water-worn materials, such as gravel, sand or clay, or an admixture of these. Especially applicable to that fragmentary matter which if consolidated into a solid would form what is known as breccia.

DETROIT (Fr. D'Etroit, strait), Mich., capital of Wayne County, in the southeast; largest city of the State and of the entire Northwest to the Pacific; situated on the northwest bank of the Detroit River dividing the United States from Canada, one end fronting west of Lake Saint Clair and the other about 18 miles from Lake Erie. It is 88 miles from Lansing, the State capital; 284 from Chicago; 60 from Toledo, Ohio; 251 from Buffalo; and 291 from Mackinaw. Pop. estimated 950,000.

Detroit has the finest harbor on the Lakes; the river, on the city front, is often called "the Dardanelles of America." The broad outlet of Lake Saint Clair, running west and dividing around Belle Isle, narrows to about half a mile and deepens to an average of 32 feet for some miles with a southwest course, before turning directly south, with a current of about two miles an hour. Fed by the Great Lakes, it has always a full stream, neither rising or sinking much, and is little disturbed by storms; and the largest vessels can lie up to the wharves. Here is built Detroit, extending some 11 miles along the river front, lined with wharves, elevators, foundries, factories, warehouses, railroad stations, freight depots, etc. Area, 80.70 square miles, but with well-built suburbs outside not yet incorporated; indeed, from Grosse Pointe at the northeast to Gibraltar at the south where Lake Erie begins, the whole river front for 30 miles is built up with handsome villages and lined with the summer villas of its wealthy business men, all really parts of Detroit. About three miles west of the centre of the city, commanding the channel, is Fort Wayne, an unfinished military post once intended to be the most formidable fortification in the Northwest, and still garrisoned and armed with batteries. Across the river in Canada are Windsor in the centre, the terminal of railroads, through Canada, Walkerville on the northeast, Sandwich on the southwest and just below Sandwich is the site of the proposed city of Ojibway, the Canadian City of the Steel Trust.

The ground of Detroit is a gentle slope for 300 or 400 feet back from the river to 20 or 30 feet high; then sinks slightly, and again rises to about 50 feet, and 661 above the sea. The original plan, on a very small scale, was a series of concentric semi-circles, or rather segments of polygons, with the Grand Circus — a semi-circular park of five and a half acres — as a centre, nearly a mile from the river, toward which they extended. This feature is still preserved; but all the new growth has been laid out in checkerboard system, relieved by a series of noble avenues, 100 to 200 feet wide radiating from the river. Jefferson avenue extends along it; Woodward avenue runs at right angles to it, dividing the city into halves and the Grand Circus into quadrants; west of Woodward are Michigan and Grand River avenues, at different angles, and east is Gratiot. Between the Grand Circus and the river is the Campus Martius, an open space about 600x200 feet, crossed by Woodward and Michigan avenues, and from which start Monroe avenue and Fort street running toward Fort Wayne. The streets in the city are generally wide — 50 to 100 feet — and in the residence district well shaded and notably clean. The chief retail business is on Woodward avenue and the streets radiating from the Grand


Main Portion
DETROIT
SCALE
0 ¼ ½ ¾ m.
Rand-McNally's 11 x 14 Map of the Main Portion of Detroit.
Copyright by Rand-McNally & Co.
DETROIT
P. M. R. CAR FERRY
TUNNEL (M. C. R. R.)
New Michigan Cen. Passenger Sta.
Union Depot
3rd St. Station M. C. R. R. D. T. & I. (Freight)
Federal Building
CLARK PARK
MACOMB PARK
STANTON PARK
CRAWFORD PARK
ELTON PARK
CASS PARK
24th St. Sta.
Vinewood Ave. Sta.
Grand River Ave. Sta.
2th St. Sta.
17th St. Sta.
MICHIGAN CENTRAL
GRAND TRUNK
DETROIT
BAY C.
Bay City Jc.
PORTAL
Michigan
Woodward
Grand
West
Trumbull
Cass
Wayne
Shelby
Griswold
Washington Blvd
Randolph
Brush
Beaubien
Hastings
Rivard
Antoinette
Stanley
Hudson
McGraw
McArthur Pl.
Kirby
Biddle
Burrell Pl.
Lawton
Stanton
Kirby
Mark
Merrick
Bryant
Putnam
Ayrella
Leila
Caroline
Warren
Hancock
Forest
Lysander
Canfield
Calumet
Willis
Alexandrine
Selden
Miller
Irving
Brainard
Charles
Pitcher
Joy
Charlotte
Elm
Bagg
Spruce
Pine
Ottawa
Locust
Perry
Butternut
Ash
Myrtle
Magnolia
Linden
Poplar
Buchanan
Williams
Tillman
Mayburry
Humboldt
Laurel
Sycamore
Noble
Marey
Fine
Talon
Ledyard
Henry
Dunfield
Gilman
Orchard
Beech
Jones
Bagley
Labrosse
Abbott
Howard
Lafayette
Savoy
Porter
Baker
Chipman
Johnson
Randall
Kendall Ave
Standish
Rose
Hyacinth
Isabella Ave
Deming
Torrey
Scotten
Lovett
La Salle
Nat
Lamman
Monteith
Richton
McKinley
Roosevelt
Beaver
Mohawk
Sylvan
Grattan
Kinsman
Breckenridge
Prentis Ave
Woodward Ave
Frank
Fuscola
Brainard St
Parsons St
Davenport
Stimson Pl
Peterboro
Sprout
Dumfield
Wolff
Palmer
Park
Uthes
Ida St
Page St
Baker St
Shady Lane
Lamble Pl
Bristol Pl
Austin St
Wind Pl
Cromwell Ave
Sampson Ave
Webster
Brevoort
Fairbanks
Vinewood
Clark
Dry Dock
Lady's
Pleasant St
Dwight St
Minnie St
McKinstry
Campau
Front
Jefferson Ave
Atwater
Riopelle
Hastings St
Halfmann St
Larned
Porter
Abbott
Howard
Lafayette
Jefferson
Atwater
Riopelle
Hastings
Halfmann
Larned
Front
Shelby
Griswold
Wayne
Cass
Woodward
Brush
Beaubien
Rivard
Randolph
Washington Blvd
Federal
Gilman
Dumfield
Sprout
Stiles
Peterboro
Davenport
Stimson Pl
Parsons St
Brainard St
Frank
Fuscola
Woodward Ave
Prentis Ave
Grand Trunk
Michigan Central
Detroit
Bay C.
Antoinette
Stanley
Hudson
McGraw
McArthur Pl
Kirby
Biddle
Burrell Pl


6
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A
B
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G
Medbury
Ave.
Holborn
Medbury
Longyear
Medbury
Hendrie
Palmer
McBrearty Pl.
D. & M. Jc.
Fern
Kirby
Frederick
Farnsworth
Theodore
Warren
Hancock
Forest
Garfield
PERRIEN PARK
Schaefer Pl.
GERMAN
East
LUTHERAN
Ave.
CEMETERY
Ave.
St.
Ave.
BELT
LINE
East
Grand Boulevard
Rakow Pl.
Josafat
Canfield
Winter St.
Willis
Superior
Alexandrine
Winter
Ave.
Ave.
St.
Ave.
Fremont Pl.
East
East
East
Sylvester
Zender
Pulford
Pulford
Mack
Stuart
Bellevue
Concord
Canton
Helen
Ave.
Martin Pl.
Woodward Ave.
Ter.
Livingstone
Brady
Rowena
Elliot
Erskine
Watson
Edmund
Pl.
Ave.
St.
Joseph St.
Edwards St.
Leland
Illinois
Mack
Hale
Scott
Pierce
Ludden
Preston
Heidelberg
Berlin
Arnot
Charlevoix
Schneider Pl.
Charlevoix
Elliot
St.
Erskine
St.
Benton
Erskine
Watson
Wilkins
Brewster
Alfred
Division
Adelaide
Winder
Napoleon
High
Montcalm
Columbia
Elizabeth
Adams
Wilkins
Brewster
Alfred
Division
House of Correction
Hunt
Hendricks
Cleveland
Waterloo
Jay
Antietam
Chestnut
Maple
Sherman
Catherine
Mullett
Clinton
Macomb
Monroe
Champlain
Fort
Congress
Larned
Jefferson
Woodbridge
Franklin
Gratiot
Ave.
Sta.
Ave.
Beacon St.
Madison
Mechanic
Bates St.
Brush St.
Brush Blvd.
Beaubien
John R.
Brush
Hastings
Rivard
Russell
Riopelle
Orleans
Stoepel Al.
Trunk
Dubois
St. Aubin
Dequindre
Cherne
Chase
Jefferson Av. Sta.
Grand
Macomb St.
Gratiot
Ave.
Sta.
Ave.
Ave.
Dubois
St.
Ave.
Campau
Joseph Campau
Mitchell
McDougall
Collins
Moran
Thompson Ct.
Hack Pl.
Mt. Elliott
Gratiot
Ave.
Ave.
Ave.

Circus and the Campus Martius. Griswold street, with the great banking houses, office buildings, etc., is the Wall street of Detroit; and others spreading from the Campus Martius and Grand Circus are of importance. The chief of the show streets is the Grand Boulevard, a macadamized parkway 150 feet wide and 12 miles long, encircling the heart of the city in a vast sweep from Belle Isle bridge at the east to the river at 26th street. The outer portions of all the great avenues mentioned, of Lafayette avenue and of Fort street, are full of fine residences; and a notable residence district clusters around Woodward avenue as it stretches toward Palmer Park.

Public Buildings and Monuments.—The chief of these are on or near the Campus Martius. Within it, facing the City Hall, is the Michigan Soldiers and Sailors' Monument, by Randolph Rogers, of bronze and granite, 55 feet high, with a colossal bronze allegorical statue of Michigan on the summit; it cost $75,000 and was unveiled in 1871. On the west, facing four streets, is the City Hall, three stories and mansard, of sandstone in the Italian style; 200x90 feet, 60 feet high to top of cornice, 180 to top of tower; it originally, in 1870, cost $600,000, and is one of the finest in the West. Near by are the handsome Wayne County courthouse, the largest public building in the city, the splendid Majestic office building, the Ford building, Penobscot building and new Dime Bank building, 22 stories high. On the north of the Campus is the Detroit opera house. The United States government building, accommodating the post-office, customs and internal revenue office and United States courts, occupies a whole block bounded by Fort and Lafayette, Shelby and Wayne streets. Within the past three years the blocks fronting the West Grand Circus have been built up with lofty office and hotel structures, and near the East Grand Circus are the Y. M. C. A. and Athletic Club buildings. Monuments to Stevens T. Mason, first governor of the State, Gen. Alexander Macomb, who commanded at the battle of Plattsburg in 1914, and Mayors Pingree and Maybury adorn the central squares.

Public Service and Improvements.—The city has 836 miles of streets, of which 593 are paved, mostly with brick, asphalt or creosote block. It has 236 miles of public sewers and 600 miles of laterals, and is inaugurating extensive additions to its sewer systems to accommodate future growth. The water supply is taken from a crib at the head of the American channel of Detroit River, 1,500 feet from the shore and at a depth of 46 feet. The pumping stations house has eight engines with a daily capacity of 250,000,000 gallons. The average daily consumption for the last reported year was 142,578,231 gallons, or 173 gallons per capita per day. The maximum for any single day's pumping was 194,000,000 gallons. There are in the system 1,076 miles of pipe and 6,350 public hydrants. The works are owned by the city and are supported by rates. The value of the waterworks buildings and pumping plants is about $5,000,000.

The city is lighted by electricity furnished by a plant municipally owned. There are 9,920 lights furnished for street lighting and the public buildings and school buildings are lighted by this plant. Private lighting and power is furnished by the Edison Company. Value of public lighting plant in 1917, $1,300,000.

The police department has a force of 1,600 men and the fire department one of 900 men, with 42 engine companies, 15 ladder companies, 7,257 hydrants and 517 reservoirs.

The electric railway system is owned and operated by a single company, the Detroit United Railway. It consists of 298 miles within the city limits and nearly 600 miles of interurban lines radiating in all directions. In 1917 there were 484,727,818 passengers carried. The fare on about one-third of the city lines is eight tickets for a quarter during the day and six for a quarter at night, with transfers to other portions of the same lines. On the rest of the city system the fare is five cents with universal transfers. There are three railway passenger stations in the city, the Grand Trunk, foot of Brush street; the Union Depot, corner of Third and Fort, accommodating the Pere Marquette, Wabash and Canadian Pacific; the Michigan Central, Michigan avenue and 15th street, accommodating that road and the Lake Shore.

Parks, Pleasure Resorts, Public Amusements, Etc.—Detroit has 31 public parks besides a number of small triangular squares caused by the intersection of the radiating avenues with the streets, often with fountains. The largest, and the principal public resort, is Belle Isle in the river, whose entire 707 acres have been parked with great beauty. It is reached by ferries and by a temporary wooden bridge. The island has cost the city for purchase price and improvements $2,021,689. The annual cost for maintenance is about $150,000. The next largest is Palmer Park, of 141 acres, on Woodward avenue, about 6½ miles from the river, sedulously made a colonial museum; it has a colonial log house; and a most interesting collection of colonial and other historical relics, besides a colonial casino. The park was a gift to the city by the late Thomas W. Palmer. Clark Park in the west has 32 acres; in part a gift from J. P. Clark. Voigt Park, 8½ acres, and the Grand Circus, in each of whose quadrants made by Woodward avenue there is a fountain, 5½ acres. Besides these, there are opportunities for delightful summer trips on the river and lakes; and the river is dotted with charming places where excursion steamers run, from Grosse Pointe, on Lake Saint Clair, famed for its cherry orchards, to Grosse Isle, where Lake Erie opens. There are 20 theatres and opera houses in the city, the largest of which are the Detroit, Garrick and Washington theatres and the Lyceum. There are also 148 moving picture theatres. The finest cemeteries are Elmwood (Protestant) and Mount Elliott (Catholic), side by side on the northeast, about two miles from the centre; beautiful in keeping and monuments; Woodmere, four miles to the southwest of the centre of the city and within the city limits; Woodlawn, a beautiful cemetery, situated seven miles on Woodward avenue, and Mount Olivet, another large (Catholic) cemetery about seven miles out at the northeast. Grand Lawn, the largest and newest, is nine miles from the city limits, on Grand River avenue. There are a number of Lutheran and Jewish cemeteries, making 23 in all.

Schools, Libraries, Newspapers, Etc.—In

1917 there were 135 public schools, of which nine were high schools. For the school year 1917–18 there were about 95,000 pupils enrolled with 2,400 teachers. Aside from the ordinary school curriculum there are classes for cripples, for the blind, for special and prevocational studies, open-air schools and summer schools. Especial attention is given to night schools for teaching foreign-born residents the English language, the rights and duties of citizenship and the elementary principles of our government. One of the high schools is a fully-equipped technical industrial training school. The school appropriations for 1917–18 aggregated $6,566,278. There are also about 80 private and parochial schools, with an enrolment of 32,000. The number of "children of school age" (i.e. 5 to 20 years) in 1917 was 164,532. For professional or higher education there is Detroit University (Jesuit); a normal training school for teachers, which is part of the public school system; the Detroit College of Medicine, which has recently been taken over by the city, the Detroit College of Law. One of the State Normal schools is at Ypsilanti, 28 miles distant, and Michigan University is at Ann Arbor, 38 miles away.

The city owns a central public library, with 14 branches, 27 school and factory stations and 455,000 volumes. The appropriation for 1917–18 was $307,000 for maintenance and $1,250,000 for a new main library building. The Bar Association has an excellent law library. The city also owns an art museum with a fine collection of paintings, statuary and Oriental curios and a good art library. During the last year 177,535 visitors passed through its turnstile.

There are in the city, including trade and advertising sheets, 124 regular publications. Of these six are English dailies, two Polish and one German.

Religion and Charities.— The church and religious assemblies and missions number 316. Of these 53 are Roman Catholic churches, 43 Lutheran, 35 Methodist, 30 Baptist, 25 Protestant Episcopal, 21 Presbyterian and 16 Jewish. Architecturally may be noted Saint Anne's, Saint Hedwig's and Saint Albertus, all Roman Catholic; the First and Fort Street Presbyterian; the Central Methodist; Trinity, Saint John's, Saint Paul's Cathedral (Episcopal); Woodward Avenue Baptist; the First Church of Christ, Scientist; church of Our Father (Universalist); First Unitarian, Woodward Avenue Congregational, First Congregational, First Baptist Church and the Temple Beth El.

The charities include a city poor fund, managed by a commission; the Detroit Associated Charities and a large number of denominational and special charities. There are several large general hospitals, of which the most noted are Grace and Harper, with training schools for nurses; Saint Mary's (Catholic); the Ford General Hospital; Kiefer Hospital for Contagious Diseases; the City Receiving Hospital; House of Providence (Catholic) and the United States Marine Hospital.

Manufactures, Commerce and Transportation.— Detroit is above all else a manufacturing centre and its most rapid growth in this respect has come within the last few years. In the calendar year 1909, according to the United States census reports, its 2,036 manufacturing establishments employed 81,011 wage earners and had a production valued at $252,939,000. It was then 13th in rank among industrial centres of the country. In 1916, according to the report of the State labor commissioner, there were 251,000 industrial employees in Detroit and its adjoining manufacturing suburbs. The value of the product was about $900,000,000 and the city stood fourth in this respect, being surpassed only by New York, Chicago and Philadelphia. A large part of this gain was due to the phenomenal growth of the automobile business. In 1909 there were 68 establishments in the city which either assembled automobiles or devoted their whole business to the making of auto parts and accessories. They employed 15,675 wage earners and their product was valued at $59,536,000. In 1916 there were 31 companies that assembled automobiles and 120 others whose sole business was the making of auto bodies, parts or accessories. They had 130,000 employees and put out 959,000 cars, valued at about $600,000,000. One of the companies, the Ford, had 42,000 men on its pay-roll and the Cadillac, Dodge Brothers, Packard and Studebaker had over 10,000 each. In 1917 and the first part of 1918 the production of cars was less rapid, as the large companies diverted part of their activities to the production of aeroplane parts, shipbuilding parts, the metal parts of munitions and other government war work. In addition to its primacy in the automobile industry, Detroit is either first or conspicuously near the front in the making of adding machines, aluminum castings, brass and bronze products, malleable iron, corsets, overalls, soda ash and furnaces. The city is also a large producer of furniture, foundry and machine shop products, tobacco and cigars.

The interests of Detroit in connection with the lake marine are great. It is first or second every year among the lake cities in shipyard production. It has the largest fleet of passenger steamers of any port in the country except New York. They number 31, with tonnage of 38,000 and licensed passenger capacity of 60,000. Several of the steamers are licensed to carry 3,500 to 4,000 excursion passengers each. Their routes include nearby ports on the adjacent rivers and lakes, and also longer trips as far as Buffalo in the East and Mackinac to the north. Detroit is also a port of call for all steamers going from Buffalo to the Upper Lakes. The tonnage passing through Detroit River is more than twice that passing through the Suez Canal, and much larger than the tonnage arriving and leaving at New York or any other seaboard port in the world. The vessel passages in 1916 numbered 37,852, with net registered tonnage of 76,677,264 and actual freight tonnage of 100,907,279.

Not only are the transportation facilities by water unsurpassed but the city is the centre of far-reaching railroads. They include the Michigan Central, five divisions; Pere Marquette, three divisions; Wabash, two divisions; Lake Shore; Detroit, Toledo and Ironton; Detroit and Toledo Shore Line; Grand Trunk, four divisions; and the Canadian Pacific. The Pennsylvania has also acquired terminals here and expects to bring in trains over its own tracks before the close of 1918.

The foreign trade of the district of Michigan, of which Detroit is the port of entry,

DETROIT, MICH.

1 Michigan Central Depot

2 Birdseye View of Campus Martius

3 Central High School

goes to a very considerable extent over the two Canadian trunk lines mentioned, reaching tide-water at Montreal. The exports for 1917 totaled $276,190,292. The largest items were foodstuffs for the allied countries in Europe. Other very large items were automobiles, iron and steel manufactures, live animals, chiefly horses and mules for war service, cotton, copper, lead and zinc. The imports for the district in 1917 aggregated in value $54,569,014.

The assessed valuation of the city for the fiscal year 1917–18 is $1,174,517,700; gross city appropriations $29,084,985; city tax levy, $16,217,985; tax rate, $13.81 on the thousand of assessments; net city debt, $20,396,385.

The bank statements for 4 March 1918 showed capital and surplus, $39,000,000; savings deposits, $139,407,372; total deposits, $334,839,632. The bank clearings for 1917 were $2,749,173,375.

Municipal Government.— Until very recently the scheme of government for Detroit comprised a common council of two members from each of the 21 wards; a board of estimates to pass upon all appropriations and bond issues, the board consisting of two members elected from each ward, five elected at large and a number of department heads ex-officio; a board of education consisting of one from each ward; various commissions appointed by the mayor and confirmed by the common council. At present the mayor has absolute power of appointment and removal of commissioners without reference to the council, and this feature is continued in the draft of a new charter which was approved by popular vote 15 June 1918. It becomes operative in some of its provisions at once, and goes into full effect in January 1919. The board of education has been reduced to seven members, elected at large. The board of estimates has been displaced by a commission consisting of the mayor, city clerk, controller and city counselor. Both these changes are retained in the new charter. That instrument also reduces the council to nine members elected at large, a change which has already had the approval by popular vote, but which has not yet gone into effect. The new charter leaves the mayor, city clerk and city treasurer elective, but gives the mayor power of appointment over most of the other administrative officials and commissions. The judges of the police and recorders' courts are elective, and the members of the board of health, being organized under the State law, are appointed by the governor.

Area and Population.— Since 1910 the city has annexed large areas of territory into which its population and business had already overflowed, thus increasing its area from 40.79 square miles to 80.70. Pop. (1910) 465,766; (1918) estimated 950,000, this estimate being based on the census of families taken annually by the water board.

History.— The following sketch is furnished by C. M. Burton, official historian of the city: "The white man first visited Detroit, so far as records show, about 1645, and the first map of the region was published in 1650. The first settlement was made 24 July 1701, by Antoine de la Mothe Cadillac (q.v.), who had been governor of Michillimackinac and wished to establish a permanent post for the centre of French power and commerce in the Northwest. He built Fort Pontchartrain, now called Detroit, and settled it with 50 soldiers and 50 colonists. During the French and Indian War, on 29 Nov. 1760, Maj. Robert Rogers took the place from the French commandant, Captain Beletre, by order from the Marquis of Vaudreuil; the garrison were sent off as prisoners, but the Canadian inhabitants were allowed to retain their farms upon swearing allegiance to the British Crown. The first act of Pontiac's conspiracy in 1763 was an attempt to seize Detroit; Pontiac was foiled, and after a desperate siege from 9 May to 12 October, heroically sustained by Major Gladwin, the post was relieved. In 1778 there were about 300 inhabitants, living mostly in log cabins, in a palisaded village. There was a Roman Catholic church in the enclosure but no other public buildings; in that year the British built Fort Lernoult, renamed Fort Shelby by the Americans, but it was not until 1796 that the place was occupied by the Americans. As part of the Northwest Territory it came under the Ordinance of 1787, and in 1802 was incorporated as a town, but in 1805 was obliterated by a fire which destroyed every building in the village except one. The town was replatted and laid out with broad streets. It became the capital on the organization of Michigan Territory in 1805. In the War of 1812, William Hull surrendered it to the British under Isaac Brock on threat of a general massacre of the inhabitants by Brock's Indians. Hull was court-martialed for this act. The British evacuated it in 1813, and the Americans reoccupied it 29 September. It was incorporated as a village in 1809 and again in 1815 and as a city in 1824. It remained the capital of the Territory till 1837, when Michigan became a State; then of the new State till 1847. Detroit celebrated its centennial 24 July 1901. Consult Farmer, 'History of Detroit and Michigan' (1889), and 'Detroit' in 'Historic Towns of the Western States' (1901); Burton, 'Cadillac's Village,' 'Early Detroit,' 'The Building of Detroit' (1896); Parkman, 'Conspiracy of Pontiac' (1867); Ross and Catlin, 'Landmarks of Detroit' (1898).

WILLIAM STOCKING,
Statistician, Detroit Board of Commerce.

DETROIT, Minn., county-seat of Becker County, on Detroit Lake and the Northern Pacific Railroad, about 200 miles northwest of Saint Paul. The town is the trade centre of a rich agricultural district and a popular summer resort because of its situation in the beautiful lake region of Minnesota. It owns its electric light and power plant. Pop. 2,807.

DETROIT, Siege and Capture of, in the War of 1812. Before war was officially declared against Great Britain a plan of invading Canada was drawn up. One part of the army under Brig.-Gen. William Hull (q.v.) was to cross from Detroit and sweep eastwardly to meet two other armies along the New York border line. On 25 May 1812 Hull began the march from Dayton with 1,600 troops under Cols. Duncan McArthur, Lewis Cass, James Findlay and James Miller (qq.v.) and after a long, tedious journey reached Detroit 5 July. On the 12th he crossed the river, occupied Sandwich, a little village on the Canadian side, three miles below Detroit, and there inexplicably remained inactive week after week, thus allow-

ing Brig.-Gen. Sir Isaac Brock (q.v.), the British commander, time to collect a formidable force. The Americans had a few minor successes, such as that at Cunard River, but on 19 and 24 July strong detachments were defeated; on 17 July Michillimackinac was surrendered by Lieut. Porter Hancks to a superior force of British and Indians; and on 8 August, just as preparations were being made to attack Malden, word was received of a defeat at Brownstown. A company of Ohio volunteers under Capt. Henry Brush was hastening with supplies to join Hull, but near Brownstown, at the mouth of the Huron River, 25 miles below Fort Detroit, met a body of Indians under Tecumseh (q.v.). Learning of this, Hull sent a force to rescue Brush, but it was ambushed, many were killed and wounded and the survivors barely escaped to the fort. Hull's dispatches were captured and sent to Brock and, therefore, knowing that the latter was aware of his desperate condition and learning that a large force of British and Indians was approaching, Hull on 8 August ingloriously returned to Detroit. On his arrival there Hull sent 600 troops under Miller to rescue Brush, but simultaneously Col. Henry Proctor set out with a body of British troops to press the advantage gained by Tecumseh. On 9 August the two forces met at Maguaga, near Brownstown and 14 miles from Detroit, and the British were routed, retreating to Malden, while Miller, having lost about 75 men, was recalled to Detroit. On the 9th Hull ordered the evacuation of Fort Dearborn at Chicago (qq.v.), but on the way the troops were attacked and massacred by Indians under Blackbird.

On 13 August the British began to place batteries on the Canadian side of the river to bombard Detroit; on the 15th Hull was summoned to surrender under threat of a massacre by the Indians; and on Hull's refusal the bombardment was begun. On the 16th the British crossed the river intending to assault the fort, but found the Americans drawn up in battle array outside the ramparts, with artillery well planted. Nevertheless the British took position without molestation and were preparing to assault when Hull, apparently desperate at the thought of a massacre, withdrew his troops from all exterior positions and decided to surrender. Thus within an hour the British found themselves in possession of the fort; not a blow was struck, not a gun was fired, not a word of consultation was had with the officers and not a single stipulation was made for the honor of the troops; but everything was unconditionally surrendered to the enemy. The loss is variously stated. Hull estimated his effectives below 800; Cass stated the loss at 1,600; while Brock reported the number captured at 2,500. The city remained in possession of the British until 1813, despite attempts to recapture it. See FRENCHTOWN.

Hull was charged with cowardice, inefficiency, neglect of duty and treason, was subsequently tried by a court-martial, which concluded its labors in March 1814, was acquitted of treason but found guilty of the other charges and sentenced to be shot. On the court's recommendation of mercy, President Madison remitted the death sentence but ordered Hull's name to be stricken from the roll of the army.

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DETROIT MUSEUM OF ART, the principal art museum of Detroit, Mich., and one of the largest of the Middle West, founded in 1885. It contains a library and has valuable collections on American art, archæology, science and on local and national history. It contains the famous Stearns collection of Oriental curios, the Scripps collection of old masters and a fine collection of Pewabic pottery. Contemporary American painters and sculptors are well represented, including Borglum, Manship, Hawthorne, Saint-Gaudens, Dewing and Chase. The museum receives an annual subsidy from the city, which in 1916 amounted to $40,000, payable in monthly instalments. Courses of lectures are given and sketch classes maintained, also a school of design for the teaching of art and design and the promotion of art studies generally.

DETROIT RIVER, a river or strait which connects Lake Saint Clair and Lake Erie and forms part of the boundary between the United States and Canada. *Detroit* is the French word for strait; and the name was given by the French, the first white men who settled here. Its course is nearly south, with slow current and sufficient depth of water for the navigation of large vessels. It is 25 miles long and from one-half to three miles wide. Opposite the city of Detroit it forms an excellent harbor. The tonnage passing through this river exceeds in volume that passing through any other river in the world.

DETROYAT, dā'trwā'yą', **Pierre Léonce,** French naval officer and journalist: b. Bayonne, Basses-Pyrénées, 1829; d. 1898. He was educated at the Ecole Navale, was in active service during the Crimean War and subsequently accompanied an expedition to China. He came to Mexico with the Archduke Maximilian and was made Under-Secretary of State for Naval Affairs in the latter's short-lived empire. In 1870–71 he was in command of the camp at La Rochelle. He was on the staff of *La Liberté* in 1866–69 and was its editor in 1869–76. He founded two journals, *Le Bon Sens* and *L'Estafette,* and in 1885–86 was editor of the *Constitutionel.* He published 'La cour de Rome et l'empereur Maximilien' (1867); 'L'Intervention française au Mexique' (1868); 'Du recrutement, de l'organisation et de l'instruction de l'armée française' (1871); 'Le sénat et le scrutin de liste' (1881); 'Nos possessions franéaise en Indo-Chine' (1887); 'Les chemins de fer en Amérique' (1886).

DEUCHER, doik'ĕr, **Adolf,** Swiss statesman: b. Steckborn, Thurgau, 1831; d. 1912. He studied medicine at Heidelberg, Zürich, Prague and Vienna. He was a member of the Thurgau canton council in 1855 and in 1868 helped to frame the new democratic constitution for Thurgau. He was a member of the Swiss National Council 1869–73 and became its president in 1882. He became a member of the Federal Council in 1883 and its vice-president in 1885. He was chosen President of the Swiss Confederacy and served until 1887. He was reelected in 1897 and 1903.

DEUS EX MACHINA, măk'in-ą (Lat. "a god out of the machine"), a Latin phrase translated from the Greek, where it was used principally in connection with the theatre. When the tragic situation of a play became so involved that the solution of the difficulty lay beyond the situation itself, a god was brought on the stage by some sort of stage machinery, and the dénouement followed quickly. The term has come to connote any extraordinary, unlooked-for agency introduced to solve a difficulty; or to designate some unknown supernatural cause introduced to explain phenomena that one is not able to account for by natural means. Consult Haigh, 'The Attic Theatre' (3d ed., Oxford 1907).

DEUTERONOMY, "Second" or "Repeated Law," the title applied in Greek, Latin and modern versions of the Old Testament to the fifth book of the Pentateuch (q.v.). The name arose from a mistranslation of the phrase "copy of law" (Deut. xvii, 18; also Josh. viii, 32), yet it has had in the past a certain descriptive force in contrasting this code of law as promulgated at the end of the wilderness sojourn with the codes of Exodus and Leviticus as given at Sinai. In Hebrew editions of the text the title is "These Words," taken from the beginning of the book.

The central portion of Deuteronomy consists of an hortatory address (v–xi) and a code of laws (xii–xxvi). Introductory matter is prefixed to this, chiefly an historical review (i–iii), and an exhortation (iv, 1–40). The closing chapters (xxvii–xxxiv) consist of miscellaneous matter concerning obedience to the law and the last days of Moses.

Deuteronomy has been one of the pivotal points in the discussions of the past century as to the true order of growth of the Old Testament literature and religion. It is now generally recognized among those who apply the principles of historical investigation to the Biblical writings that, in the development of Hebrew law, Deuteronomy stands between the briefer and simpler codes of Exodus xxxiv and xx–xxiii and the elaborate, priestly law of Leviticus. With some slight modifications, almost the entire contents of the "Book of the Covenant" (Ex. xx, 20–xxiii, 33) is taken up into this new "Covenant" code, which may itself be counted Mosaic in the sense that all the written law of Israel is an organic growth springing in the first instance from the creative work of that great leader. A comparison of the thought and style of Deuteronomy with the historical and prophetic writings similarly suggests its composition between the historical documents of the 9th and 8th centuries and the 8th century prophets (Amos, Hosea, Isaiah, Micah) on the one hand and, on the other, the historical writings and the prophets (Jeremiah, Ezekiel) of the end of the 7th and beginning of the 6th centuries. A further comparison of the contents of Deuteronomy with the account of the finding of the book of the law and the reforms based upon it in the 18th year of Josiah's reign (2 Kings xxii–xxiii) makes it clear that the law promulgated in 621 B.C. was that of Deuteronomy and no other. The composition of the main body of the book may thus be assigned to the period between 700 and 621 B.C. The introductory and concluding chapters seem to have been added not long after 621.

The great prophets of the 8th century had called upon the people to reform their entire civic, economic, and religious life in conformity with the newly apprehended requirements of a sole Deity, who demanded justice and mercy rather than religious ceremonies. The prophets had applied these demands to dishonest business dealings, bribery, oppressive monopoly and to established religious customs in a way that united religious conservative and selfish exploiter against the much needed reforms. In the reign of Manasseh beginning early in the 7th century there was a great reaction against the reforms undertaken; now anyone who dared to teach publicly the doctrines of the recent prophets met speedy death. It was probably at this time that followers of the prophets secretly compiled the central law code of Deuteronomy and composed the wonderful hortatory address of chapters v–xi, which bases its appeal to obey the law upon the most generous motives of gratitude to God and sympathy for man. The book was probably laid away in one of the Temple chambers until a favorable time for its public reading should be found. Its authors may already have been dead when it came to light in the repairing of the Temple instituted by Manasseh's grandson, Josiah.

The prophets of the previous century had made an antithesis between spiritual religion and worship. Deuteronomy undertook a great synthesis of the two, seeking to purify worship from pagan license and to use it as an expression of love to God and kindness to man. In order to purify, Deuteronomy changed the old law that permitted altars in various places (Ex. xx, 24) and centralized the cultus at Jerusalem.

The ground of Sabbath observance was made rest for the servants as well as the master. In the joyous harvest feasts the servants, landless Levites, foreign sojourners, fatherless, and widows were to be given opportunity to share, and the tithes of the produce were to go for the nourishment of these classes. Emphasizing justice, mercy, and knowledge of God as the supreme things, Deuteronomy sought to formulate laws which should give effect to these principles in worship, business, family life, and the entire conduct of the nation. The perpetuity of the nation was indeed declared dependent upon faithfulness to the covenant of Sinai, which required loyalty to Jehovah expressed in a purified worship and a righteous, benevolent social order.

Upon the tragic death of Josiah and the establishment of Egyptian suzerainty the nation reacted sharply against the exacting demands of Deuteronomy. The Babylonian exile followed speedily and burned the warnings of Deuteronomy into the hearts of some thoughtful Jews. Out of these conditions there sprang a school of historians who composed such works as Judges and Kings with the primary purpose of enforcing the great lessons of Deuteronomy.

In literary form this book marks a transition in the growth of the Old Testament scarcely less obvious than that in thought. Its rounded periods and solemn, sonorous tone are in marked contrast to the simple, picturesque style of the earlier prose of Israel; here again its influence is plainly seen in the writings that follow the time of its publication.

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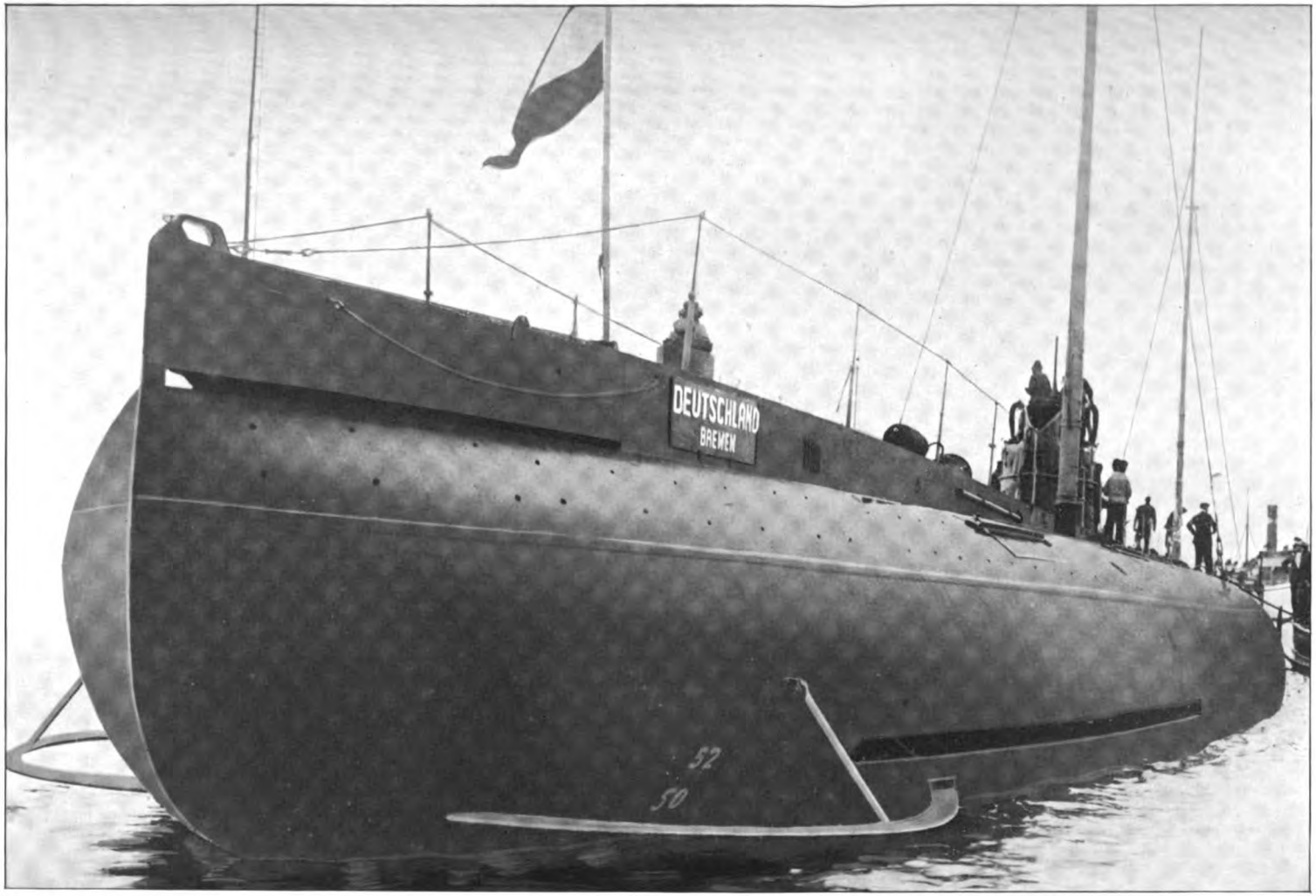
DEUTOPLASM. See EMBRYOLOGY.

DEUTSCH, doitsh, **Gotthard,** American Hebrew scholar: b. Kanitz, Austria, 31 Jan. 1859. He was graduated at the University of Vienna in 1881 and came to the United States in 1891. He was a member of the editorial board of the 'Jewish Encyclopædia' and is a member of the Cincinnati Board of Education. He is professor of Hebrew at Union College, Cincinnati. He has written 'Symbolik in Cultus' (1886); 'Theory of Oral Tradition' (1895); 'Philosophy of Jewish History' (1897); 'Andere Zeiten,' a novel (1897); 'Unloesbare Fesseln,' a novel (1902); 'Memorable Dates of Jewish History' (1904); 'Israel Bruna,' a tragedy (1908); 'History of the Jews' (1910); 'Der Glaube an Hobelspaene,' a survey of modern Judaism (1915); and numerous articles in encyclopedias and periodicals.

DEUTSCH, Leo Grigorevitch, Russian revolutionist: b. Kiev 1855. He was educated in his native place, joined the Russian revolutionary movement in 1874 and in 1876 was arrested, ostensibly as a deserter from the army, but in reality because of his revolutionary tendencies. He managed to effect his escape and in the following year, with a confederate, started to organize a revolt among the peasantry of Kiev. Their plans being discovered, Deutsch was arrested, spent a year in Kiev prison awaiting trial and again managed to escape to Switzerland, where he joined a group of Russian terrorists, became a Socialist and in 1883 was one of the founders of the Russian Social-Democratic party in Switzerland. In 1884 he was arrested in Germany, with literature of the party in his possession, and Bismarck managed to have him extradited to Russia. He was exiled to Siberia for 13 years and four months, but again escaped in 1901 and returned to Switzerland through Japan and America. He was one of the editors of the Socialist journal, the *Spark*. In 1905 he returned to his native land after the Tsar had manifested a conciliatory policy. The reaction of the following year again led to Deutsch's arrest and sentence of exile to Siberia. For the fourth time he eluded his guards and escaped to France. He came to America in 1911 and for about a year was editor of the Russian Socialist weekly, *Novy Mir*. Consult his 'Sixteen Years in Siberia' (New York 1903) and 'Viermal Entflohen' (Stuttgart 1907).

DEUTSCHBROD, doich'brōt, Bohemia, the capital of a district, on the Sazawa, 16 miles north of Iglau. The town has lumber and grist mills, glass works, breweries and woolen mills. In 1422 Ziska defeated the Emperor Sigismund here. The town was destroyed by the Hussites. Pop. about 6,600.

DEUTSCHE BANK, The. The Deutsche Bank (Deutsche Bank in Berlin) was founded in 1870 with a capital of 15,000,000 marks. Its object, as stated in its charter, was "the transaction of all sorts of banking business, particularly the fostering and facilitating of commercial relations between Germany, the other European countries and over-seas markets." Previous to its founding, German importers and exporters were dependent upon English and French banking institutions in the world markets — a serious handicap in that German bills were almost unknown in international commerce, generally disliked and subject to a higher rate of discount than English or French bills. The wisdom of its establishment is evident. Following certain difficulties and criticisms during its early years, the Deutsche Bank in time established branches and connections that have given it an international standing. In 1873, after one failure and another partially successful attempt, a branch was opened in London — a prime necessity for the establishment of credit in the world's money centre for the German trade. In addition, to keep in touch with the great promising export and import centres, branches were opened at Bremen (1871), Hamburg (1872), Frankfort-on-the-Main (1886), Munich (1889), Leipzig and Dresden (1900), Nüremburg (1905), and Constantinople (1909). In addition, it has two silent partnerships, known as "commandites," and 77 deposit offices. Subsidiary offices have been founded in whole or part by the Deutsche Bank in the United States, Asia, South America (seven countries),



THE "DEUTSCHLAND" AT BALTIMORE, MD., JULY 1916

Spain, Italy, East Africa, Central America and Mexico; the whole representing a large capitalization. In addition, communities of interest have been established with 13 important banks throughout Germany, these last having 94 branches. Through its ramifications there is hardly a financial organization in any community in the German Empire in which the Deutsche Bank has not some proprietary connection; and no commercial country in which it has not an active or silent financial connection. In addition to its purely banking functions, it has representatives on the boards of German and foreign manufacturing and trading organizations, many of which are pre-eminent internationally in their respective lines. This representation in 1910 concerned 116 such institutions. The capital of the Deutsche Bank (1915) was 250,000,000 marks; surplus, 180,000,000 marks; and dividend 12½ per cent. The capital power of the Deutsche Bank group (1908) was 786,858,095 marks, of which 588,900,800 marks constituted capital, and 197,957,295 marks surplus. Consult Riesser, J., 'Die deutsche Grossbanken und ihre Konzentration' (1909); 'Germany's Economic Forces' (1913); 'Report on Cooperation in American Export Trade' (Washington 1916).

DEUTSCHLAND, The, a German submarine merchant vessel, the first of its class to cross the Atlantic Ocean. Commanded by Capt. Paul Koenig and a crew of 28 men, the boat sailed from Bremen 14 June 1916, stopped at Helgoland for nine days and then set out for Baltimore, Md., arriving 10 July 1916. The whole distance of about 3,800 miles, with the exception of about 90 miles when it was necessary to submerge, was traversed above water. The speed of the vessel was about 14 knots an hour. While the vessel could submerge to a depth of 300 feet, it did not go deeper than 150 feet. With a total gross tonnage of 711 tons, net 447 tons, and scuff iron for ballast, *The Deutschland* brought 3,042 cases of scarce and valuable dyestuffs of 157 tons gross, 125 tons net. The daring voyage attracted great admiration and praise. While both British and German submersible boats on warlike errands had sailed as far, *The Deutschland* was the first to achieve a noteworthy victory of a peaceful utilitarian commercial character during her hazardous voyage through enemy waters, without armed escort, eluding pursuers and accomplishing her mission safely. The vessel left Baltimore at 8:30 P.M. 2 August on her return journey, carrying a cargo of rubber, crude nickel and a consignment of gold, and arrived at Bremen 23 August. A sister ship, *The Bremen,* left port shortly after and never arrived at its destination. *The Deutschland* accomplished a second voyage across the Atlantic in 17 days and arrived in New London, Conn., 1 Nov. 1916, bringing a cargo of chemicals, gems and securities valued at $10,000,000. She departed 17 November, but within an hour was compelled to return to port for repairs, having rammed and sunk an escort tug, drowning five of the crew.

DEUTZIA, doit'sĭ-a, or dūt'sĭ-a (so named in honor of the Dutch botanist Deutz), a genus of plants of the family *Hydrangeaceæ,* containing 50 species, all of which are interesting for the beauty of their flowers. Some of the species are cultivated in America as hothouse flowers or ornamental shrubs. The nearest relatives growing wild in the United States are the syringas (*Philadelphus*). The deutzias are small shrubs indigenous to Asia, one species occurring in Mexico. They are covered with stiff stellar hairs, on which account one species (*D. scabra*) is used by joiners in Japan to polish wood. The flowers are arranged in thyrsi like the lilac.

DEUX-PONTS, dė'pôn', the French name for the German town of Zweibrücken, in Latin *Bipontium,* all which names signify two-bridges. There was formerly a county of this name, which took its name from this town, which is now in the Bavarian Palatinate. It was afterward erected into a duchy. By the Peace of Lunéville (1801) the duchy was ceded, with all the left bank of the Rhine, to France, and afterward composed a part of the department of the Donnersberg. It contains 70,000 inhabitants, on 760 square miles. By the peace of 30 May 1814 it was restored to Germany. See ZWEIBRÜCKEN.

DEUX-SÈVRES. See SÈVRES.

DEV, dāv (Persian, demon), identical with *daeva* of the Avesta and the Sanskrit *deva.* According to Zoroaster these beings were created by Ahriman and are frequently represented as a source of guile, cunning and evil. Consult Geiger and Kuhn, 'Grundriss der iranischen Philologie' (Vol. II, Strassburg 1896–1904).

DEVA, dā'vą (Lat. *deus, divus*), among the Aryans in general, an epithet of divine persons and things; hence often opposed to the *dev* of the Parsees. It is commonly applied to the goddess Durgā, the wife of Śiva, of terrific form and irascible temper. Devakātmajā is the mother of Krishna, who is also named Devākī. Devatarū is the holy fig-tree, belonging to Sverga or paradise. Devatā denotes a deity; Devadatta, the younger brother of Buddha, who is called Devadattarraja (Deodatus senior). Devadeva is a name of Brahma; Devapati is Indra, the god of the sky; Devayajna is the Homa or burnt sacrifice; Devarishi a celestial saint. There are many great classes of choirs of inferior devatās, who are ministers to the higher gods, such as the 12 Adityas or forces of the sun; the Maruts or winds, the celestial musicians; in short, endless motley hosts with variable attributes.

DEVA-DASI. See BAYADERE.

DEVANAGARI, dā'vą-nā'gā-rē, or **NAGARI,** the name of the character in which Sanskrit is written, especially in northern and middle India. Devanagari means "writing of the divine city" and Nagari "(writing) of the city, urban." The alphabet consists of 48 letters written from left to right. It is believed to have reached its present form about 700 A.D. and is traced to the oldest form of Indian alphabet, the Brahmi lipi, or writing of Brahma, which is known from coins, etc., of about 350–400 B.C. This Brahmi is itself supposed to be an adaptation of a form of Semitic writing which reached India about 800 B.C. Kircher's 'China illustrata' (Amsterdam 1667) contains five tables of Devanagari letters contributed by Heinrich Roth, a missionary. Consult Bühler, 'Indische Palāographie' (Strassburg 1896), and Taylor, 'The Alphabet' (Vol. II, London 1899).

DEVAPRAYAGA, dā-vä-prä-yä'gä, or **DEOPRAYAG,** India, a sacred city of the Hindus, in the district of Garhwal, Northwest Provinces, on a mountain side, 2,266 feet above the sea, in the fork of the Alaknanda and the Bhagirathi, which join to form the Ganges. Devaprayaga possesses a notable temple and is a favorite place of pilgrimage. See DEOPRAYAG.

DEVAUX, dė-vō', **Paul Louis Isidor,** Belgian statesman: b. Bruges 1801; d. 1880. He was educated at Liége and early entered the political arena. In 1824, in conjunction with Lebeau and Rogier, he founded the *Journal Politique,* and in 1830, with the same associates, established the so-called Doctrinal party. Through the journal Devaux drew together the Catholic and Liberal elements and consolidated the opposition to William I, king of the Netherlands, to the extent of being largely instrumental in bringing about the separation from Holland and the setting up of an independent government. Devaux assisted in framing the constitution and also the Treaty of London. He was made Minister of State in 1831, but soon afterward resigned. He became leader of the Moderate Liberals in the Chamber and for several years edited the party organ, the *Revue Nationale,* which he founded in 1840. In his last years he was afflicted with blindness. He published 'Mémoires sur les Guerres mediques' (1874), and 'Études politiques sur les principaux Événements de l'Histoire romaine' (1880).

DÉVAY, dā'voi, **Mátyás Biró,** Hungarian leader of the Reformers: b. Déva, Transylvania, about 1500; d. 1574. He studied theology at Cracow, was ordained a priest and in 1529 embraced the doctrines of the Reformation. Thereafter he spent two years with Luther at Wittenberg, and on his return home preached the new faith abroad at the risk of his life until 1534, when he secured the protection of a nobleman. The Turkish invasion of 1541 obliged him to flee to Switzerland, where to Luther's great regret he adopted the sacramental doctrines of Zwinglius. For many years previous to his death he labored zealously at Debreczin, Hungary.

DEVELOPING IN PHOTOGRAPHY. See NEGATIVES, DEVELOPMENT OF; PHOTOGRAPHY.

DEVELOPMENT HYPOTHESIS, the doctrine that all nature, inanimate and animate, is the result of a gradual unfolding of inherent qualities and powers, with ever-increasing combinations and complexity, from certain assumed primordial elements, the origin of which is unknown. In biology the term is specifically applied to the alleged derivation of modern differentiated forms (species) of animals and plants from early synthetic types. See ANIMALS, CLASSIFICATION OF; EVOLUTION; DARWINIAN THEORY, etc.

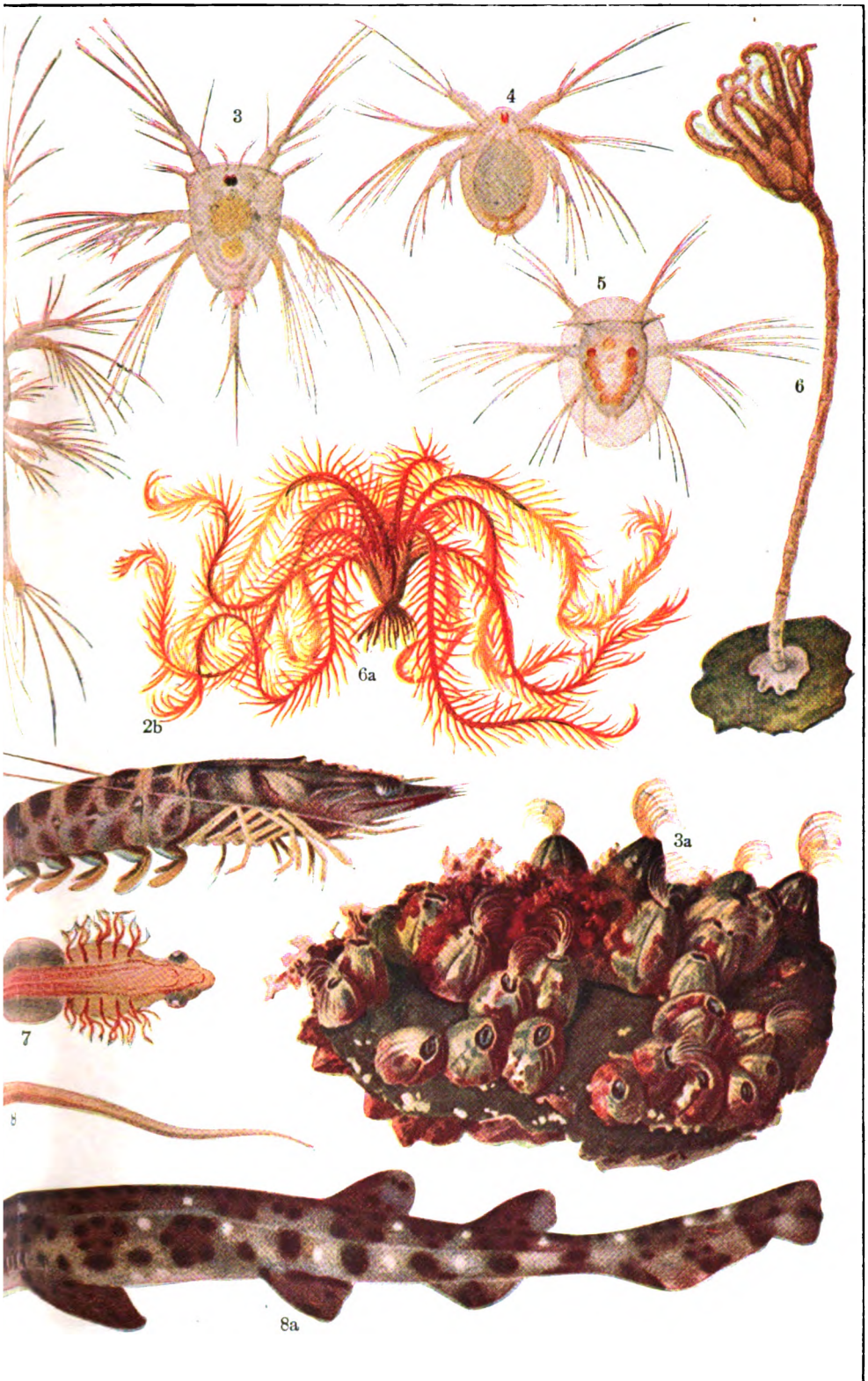
DEVENS, Charles, American jurist and general: b. Charlestown, Mass., 4 April 1820; d. Boston, Mass., 7 Jan. 1891. He was educated at Harvard, became a member of the State Senate in 1848–49, and was United States marshal for the district of Massachusetts at the time when the case of Thomas Sims, a fugitive slave, attracted widespread attention. Devens delivered Sims to his master in accordance with the law, and afterward tried to purchase his freedom, but did not succeed until after the outbreak of the Civil War. He served in the Union army from 1861 to 1865, retiring with the full rank of brigadier-general and the brevet rank of major-general. In 1873 he was made associate justice of the Massachusetts Supreme Court; in 1877 became Attorney-General of the United States, and in 1881 resumed his place on the Supreme bench of his native State. His orations and addresses with a memoir by John C. Ropes were published in Boston 1891.

DEVENTER, dā'vĕn-tėr, or **DEMTER,** Holland, ancient town in the province of Overyssel, eight miles north from Zutphen, on the navigable river Yssel and 66 miles east of Amsterdam. It has a large town-hall, a courthouse and prison, places of worship for Calvinists, Lutherans, Mennonites, Roman Catholics and Jews. The Groote Kerk has a fine Gothic tower and a crypt dating from the end of the 11th century. The followers of Gerard Groot, or "the Brethren of the Life in Common," have their college here. Besides the manufacture of carpets and Royal Smyrna rugs, there are factories for the molding of iron, cigar making, rope and glue making. Cotton products are also manufactured, and a certain honey cake known as "Deventer Rock." Considerable trade is carried on in linen, agricultural products and grain. Erasmus spent his boyhood here. Pop. 28,223.

DE VERE, dę vēr', **SIR Aubrey Hunt,** Irish poet: b. Curragh Chase, Ireland, 28 Aug. 1788; d. there, 5 July 1840. His works are 'Julian the Apostate: a Dramatic Poem' (1822); 'The Duke of Mercia: an Historical Drama,' the volume containing also 'The Lamentations of Ireland' (1823); 'The Song of Faith, Devout Exercises and Sonnets' (1842), and 'Mary Tudor: an Historical Drama,' published posthumously (1847). His sonnets Wordsworth declared to be "the most perfect of our age."

DE VERE, Aubrey Thomas, Irish poet and essayist: b. Curragh Chase, Ireland, 10 Jan. 1814; d. there, 21 Jan. 1902. He was a son of Sir Aubrey De Vere (q.v.) and became a Roman Catholic in 1851. In 1842 his first volume of verse appeared, 'The Waldenses,' and 'The Search after Proserpine' (1843). His subsequent books of verse include 'Poems, Miscellaneous and Sacred' (1853); 'May Carols' (1857); 'The Sisters' (1861); 'The Infant Bridal' (1864); 'Irish Odes' (1869); 'The Legends of Saint Patrick' (1872); 'Alexander the Great' (1874); 'Legends of the Saxon Saints' (1879); 'The Foray of Queen Meave and other Legends of Ireland's Heroic Age' (1882); 'Legends of the Records of the Church and the Empire' (1887); and 'Saint Peter's Chains' (1888). Among his prose works are 'English Misrule and Irish Misdeeds' (1848); 'Picturesque Sketches of Greece and Turkey' (1850); 'Ireland's Church Property and the Right Use of It' (1867); 'The Church Establishment of Ireland' (1867); 'Constitutional and Unconstitutional Political Action' (1882); 'Essays, Chiefly on Poetry' (1887); 'Essays, Chiefly Literary and Ethical' (1889); 'Recollections of Aubrey de Vere' (1897).

1, 1a, 1b. Various stages of the Turbot. 2, 2a, 2b. Development of the Shrimp. 3. I
4. Female living in body of an Ascidian. 5, 5a. Forms of a Peltogaster. 6, 6a. Forms



ree-Swimming form, and 3a, Sessile form of Barnacle. 4, 4a. Forms of a Nautopterus.
of a Crinoid. 7, 7a. Torpedo embryo and adult. 8, 8a. Embryo and adult Dog Fish.

DEVEREUX, Robert. See ESSEX, 3D EARL OF.

DEVERON, a river of Scotland, in Aberdeenshire and Banffshire, which flows into the sea at Banff. It is about 50 miles long. The salmon-fishery is very valuable.

DĒVI, dā'vē, in Hindu mythology, "the goddess," or Mahadevi "the great goddess," wife of the god Shiva and daughter of Himavit (that is, the Himalaya Mountains). She is represented as a being of two characters, one gentle, the other fierce, and it is under the latter aspect that she is generally worshipped. In the Mahabharata she appears under many forms, and her individuality is fully developed in the Puranas.

DEVIATION, in the law of marine insurance, an unnecessary departure from the course of the voyage insured. The legitimate reasons for departure from the course are stress of weather, want of repairs, joining convoy, succoring ships in distress, danger from an enemy, sickness and mutiny. Even in these cases the quickest courses must be taken. Deviation, from the moment at which it commences, discharges the underwriter from all liability.

DEVIATION OF THE COMPASS, the deviation of a ship's compass from the true magnetic meridian, caused by the proximity of iron. In wooden ships no magnetic deviation is perceptible so long as the ship is heading north or south. The greatest deviation is seen when the vessel heads east or west. In iron ships the magnetism is fixed by hammering and riveting, and the deviation manifests itself exactly in accordance with the point toward which the hull headed while these processes were going on. Armor-plated ships should be plated with their head in a different direction from that in which they lay when built. The mode now generally employed to correct deviation is by introducing on board ship masses of iron and magnets to exactly neutralize the action of the ship's magnetism. Compasses are sometimes carried on masts as a means of removing them from the disturbing influence of the iron of the hull. In this position they serve as standards of comparison for the binnacle compass. Wooden ships are also magnetized, so as to affect the compass, though in a far less degree, by the direction in which they lie when building.

DEVIATION OF THE PLUMB LINE. See DEFLECTION OF THE PLUMB LINE.

DEVICE, an emblem, with an accompanying motto or legend used to convey a hidden meaning of some particular conceit of the wearer. Such emblems became general in the 14th century, and were borne only by the person who assumed them, and not, like the crest, by the family or descendants. Louis XIII of France had a falcon as a device, with the legend *Aquila generosior ales* (a nobler bird than the eagle), by which he claimed superiority to the emperor. Consult Radowitz, 'Die Devisen und Mottos des spätern Mittelalters' (Stuttgart 1850).

DE VIGNY, dė vē'nyē', **Alfred, Comte,** French novelist and poet: b. Loches, Indre-et-Loire, 1799; d. 1863. He received his education in Paris and served in the army 12 years. In 1822 appeared his 'Poèmes' and in 1824–26 his 'Poèmes antiques et modernes.' These were among the earliest attempts to deal in epic form with philosophic subjects. 'Eloa' appeared in 1824 and served as model for Lamartine's 'Chute d'un Ange.' In 1826 De Vigny published his great historic novel 'Cinq-Mars,' which though a falsification of history attained an immediate and splendid success. It was the forerunner of the historic tales of Hugo and Dumas. In 1829 he translated Shakespeare's 'Othello' and wrote the comedy 'Quitte pour la Peur.' These were followed by 'Stello'; 'Servitude et Grandeur militaires' (1835), military stories and his best work in fiction. His drama 'Chatterton' (1835) is his best despite its pessimistic tone throughout. After his death appeared the 'Destinées' (1864) and 'Le Journal d'un Poète' (1867), remarkable for their lyric strength. De Vigny's works were edited in 1863–66, in 1868–70 and in 1883–85. Consult the biography by A. France (Paris 1868); also Caro, 'Poètes et Romanciers' (ib. 1888); Faguet, Émile, 'Dix-neuvième Siècle' (ib. 1890); Sainte-Beuve, 'Portraits littéraires' (Vol. III, ib. 1893); Séché, L., 'La Vie litteraire politique et religeuse; la Vie amoureuse d'Alfred de Vigny' (ib. 1913).

DEVIL (O. E. deofol; O. S. diubal; O. H. G. tiufal; M. G. Teufel; Gothic, diabolus, from Gk. διάβολος, a slanderer), an evil spirit, Satan, the tempter, slanderer and tormentor of human beings, according to the Scriptures of the Old and New Testaments. Most of the old religions of the East acknowledged a host of demons not good or bad, but merely exercising a salutary or injurious influence. In the latter case they were looked upon as punishing spirits, without inimical or wicked purpose. Siva, the judging and destroying god of the Indian mythology, is a symbol of the great power of nature, which is alternately beneficent and injurious, but in itself neither good nor evil. Zoroaster named this evil principle *Ahriman.* The Greek mythology did not distinguish with the same precision between the good and bad spirits. Beelzebub, or Beelzebul, appears to have been regarded by the Jews as the prince of devils. According to the Mohammedans, who have derived their account from Jewish traditions, the devil, or, as they sometimes call him, *Eblis,* was an archangel, whom God employed to destroy the *jinns* or genii, a race intermediate between men and the angels, who tenanted the earth before the creation of Adam.

The Satan ("adversary") of the New Testament is a rebel against God. Endowed with the intellect and power of angels, he uses them since his fall to entangle men in sin, and obtain power over them.

The doctrine of Scripture on this subject soon became blended with numerous fictions of human imagination, with the various superstitions of different countries and the mythology of the pagans. The gods of the ancients became evil spirits, seeking every opportunity to injure mankind. The excited imaginations of people frequently led them to suppose Satan visibly present; and innumerable stories were told of his appearance, and his attributes distinctly described. The writings of the fathers of the Church also contain several passages re-

specting the appearance of the devil. In many works or appearances of an extraordinary character, the devil was supposed to be concerned. Thus, many a dam, bridge, etc., has been built in one night with his assistance, and everyone knows that superstitious writers of former days, applying the legends that had become connected with Dr. Faust, the reputed worker of magic, to Fust, to whom the invention of printing has frequently been ascribed, taught that he invented the art by the help of Satan. The modern tendency is to regard the personal Devil as a part of the mythology of early times when men conceived the world forces as endowed with personal form. This is due to the advance of medical and natural science, better methods of historical criticism and modern philosophy. Consult Carus, 'History of the Devil' (Chicago 1900); Conway, 'Demonology and Devil Lore' (London 1878); Grimm, 'Deutsche Mythologie' (4th ed., Berlin 1878); Horst, 'Dämonologie' (Frankfort 1818); Lecanu, 'Histoire de Satan, sa chute, son culte, ses manifestations, ses œuvres' (Paris 1861); Mayer, 'Historia Diaboli' (Tübingen 1780). See DEMONOLOGY.

DEVIL, Tasmanian, or DEVIL-DEVIL. See DASYURE.

DEVIL, The, a tavern which once stood near Temple Bar, in Fleet street, London, where the Apollo Club met. Its site is now occupied by Child's Bank.

DEVIL IN ART AND SYMBOLISM. All representations of the Devil during the first four centuries of our era appear to have been that of a serpent tempting Eve. In a fresco in the cemetery of Sainte-Agnes Satan is figured in the form of a human bust terminating in a serpent's tail. On several early Christian sarcophagi is seen a serpent twined around the trunk of a tree, the head is erect and threatens some doves, whose nest reposes on the tree, M. Le Blant declares that it is an error to consider this, as is frequently done, as a representation of the Devil threatening Innocence; this scene, he says, has nothing of the symbolic, but is an ornamental motif borrowed from antiquity by Christian art. As a rule, in the temptation of Adam and Eve, the serpent, with his body encircling a tree, is depicted with an apple in his jaws. In the Middle Ages artists frequently placed the head of a young man or women on the serpent form. Again, in the Bibliothèque Nationale, Paris, is an Italian miniature which displays a serpent with two human heads, one looking at Adam, the other at Eve. In a 14th century manuscript ("Speculum humanæ salvationis") Didron found the "tree of the Knowledge of Good and Evil" surrounded by two serpents, each offering a fig, one to Adam, the other to Eve. The use of the serpent form to symbolize the Devil is confined to the "temptation" scene, the depiction otherwise being given the conventional demon of grotesque form. Hulme describes an illustration of the Devil in a 14th century missal, in which Satan has great tusks protruding from his mouth and curling up nearly to the eyes; his ears are long and pointed. Other heads appear at shoulders and thighs, and from the mouths of these heads issue the figure's arms and legs; the arms terminate in bear's claws, the legs in eagle's talons. This figure's body is open at the waist exposing a nest of serpents darting forth; large scales cover the rest of the body. In old works of art we find the Devil given the same form as his imps, half man, half beast, and furnished with a tail and horns. Incidents in the lives of the saints are generally depicted with the devil in such form. Horses' hoofs or a cloven foot are commonly a part of the personality; and the wings of a bat are often added to increase the Satanic hideousness. When picturing the Devil as "the devouring monster" he generally takes on the form of a dragon. In pictures of Saint Michael in combat with the Devil Satan is depicted in a dragon's form; except rarely, when he is a two-legged creature having a monstrous head with a bird's beak, and is covered with scales. The German Renaissance artists were fond of giving the Devil a crow or raven form. In order to give Satan a special personality the painters of the Middle Ages frequently depicted him as black, but he is found also as red, blue and even green. Besides the above impersonations the evil spirit has been portrayed as lion, hog, boar and monkey, also basilisk. Another variation used in the Middle Ages was that of a monster with three heads each devouring one of the damned; a statue dating from the 12th century in Sainte-Basile d'Étampes has this form. Byzantine artists frequently pictured Satan as "cast out of Heaven" in which case he takes on a personality of black-winged demon. More adapted to modern conceptions are the depictions of the Devil in the form of a young gallant, or of a young girl. A few pictures by great masters which contain Satan are: One by Niccola of Pisa, in which the Devil has the form of a satyr; Orcagna's 'Hell' in Saint Maria Novelle, Florence, depicts the prince of demons as Pluto; Saint Michael's combat with Satan has been painted by Raphael (in Louvre); by Guido (in the Capucine Church, Rome); by Jacobello del Fiore (in Berlin Museum); by Lucas Giordano (in Belvedere, Vienna). Another favorite subject with artists is the 'Temptation of Christ.'

According to Husenbeth the following saints have been pictured in connection with the Devil: Saint Demetrius (martyr) has been represented with the Devil appearing to him in prison as a scorpion; Saint Goar (confessor) has been depicted with the Devil on his shoulder; Saint Albert (Carmelite) has been pictured driving away the Devil in the form of a young woman, but with horns and a fish's tail; Saint Anthony (abbot) has been portrayed having the Devil at his feet, or with the Devil in the form of a goat; Saint Apollinaris (bishop martyr) has been represented beating the Devil with a club, as also Saint Nicholas of Tolentinum; Saint Hilarion has been depicted mounted on an ass, driving the Devil away with the sign of the cross; Saint Hidulphus has been pictured casting the Devil out of a boy; Saint Zeno of Verona has been portrayed casting the Devil out of a woman; Saint Hermes has been represented on horseback casting the Devil out of a woman led by a man with a rope, or with the Devil issuing out of the mouth of a child; Saint Melanius also has been depicted driving out the Devil; Saint Germanianus has been pictured casting

out the Devil standing near him; Saint Anthony of Padua has been portrayed vanquishing the Devil; Saint Norbert has been represented with the Devil at his feet, or chained up; Saint Oswald (bishop confessor) has been pictured driving the Devil off a large stone; Saint John Thaumaturgus has been depicted driving the Devil out of people; Saint Gaudentius of Rimini has been portrayed administering Holy Communion to a man while the Devil is issuing from him; Saint Theodore (bishop confessor) has been represented trampling on the Devil; Saint John Gualbert has been depicted standing on the Devil, a cross and tau staff set on the Devil's head; Saint Benedict has been portrayed with the Devil on each side of him, he piercing one of them through the head with the foot of his pastoral staff; Saint Theodulus has been represented with the Devil at his feet having a great bell; Saint Cyriacus has been depicted with the Devil or dragon under him, or chained near him; Saint Wulstan has been pictured fixing his pastoral staff in Saint Edward's tomb, the Devil behind him with a hook; Saint Dunstan has been portrayed seizing the Devil by the nose with red-hot pincers; Saint Justina has been represented vanquishing the Devil by the cross; Saint Euphrasia (410 not of 1534) has been depicted trampling on the Devil, or the Devil throwing her into a well; Saint Dympna has been pictured leading the Devil bound; Saint Gertrude of Nivelles has been portrayed with two mice at her feet and the Devil mocking at her side; Saint Juliana has been represented as scourging the Devil, held by a rope round his neck, or holding the Devil in chains; Saint Theodora (empress) has been pictured with the Devil taking hold of her hand; Saint Genevieve has been pictured with the Devil on her shoulder blowing out her lighted candle with a bellows.

CLEMENT W. COUMBE.

DEVIL IS AN ASS, The, a comedy of Ben Jonson (1616), which sets about proving the thesis laid down in the title.

DEVIL-IN-THE-BUSH. See NIGELLA.

DEVIL OF EDMONTON, The. See MERRY DEVIL OF EDMONTON.

DEVIL-FISH, huge rays of the family *Mantidæ,* which have a lozenge-shaped disc broader than long, with the head free from the pectoral fins and provided with a pair of anterior processes and the tail long and whip-like. The two genera and six or seven species are confined to warm seas. So far as known the young are produced alive after the eggs have hatched within the oviduct. The best-known species are *M. birostris,* sometimes called the blanket-fish by tropical American pearl-fishers, from their belief that it attacks and devours men after enveloping them in its great wing-like pectoral fins, which reach a breadth of 20 feet. It is common in tropical American waters and occurs on both the Atlantic and Pacific coasts of the United States. The name also applies to the *Octopus* and allied eight-armed *Cephalopoda.*

DEVIL UPON TWO STICKS, The. Foote's English adaptation of Le Sage's 'Le Diable Boiteux.'

DEVIL-WORSHIP, the worship paid to the devil as a malignant deity, or the personified evil principle in nature, by many of the primitive tribes of Asia, Africa and America, under the assumption that the powers of evil are as mighty as the powers of good and have in consequence to be conciliated. There is a sect called Devil-worshippers, or Yezidees, inhabiting Turkish and Russian Armenia and the valley of the Tigris and numbering more than 200,000. They venerate the authority of the Old Testament above that of either the New Testament or the Koran. They practise both infant baptism and circumcision and have a religious ministry of four orders. Their Christian ideas have reached them through Gnosticism. They pay respect to the devil, to Christ and to Allah or the supreme being, and also worship the sun.

DEVILLE. See SAINTE-CLAIRE DEVILLE.

DEVILLE, dė-vēl', **Jean Achille,** French antiquarian: b. Paris 1789; d. 1875. He was made director of the museum of Rouen and wrote several works on local history and archæology, including 'Histoire du Château-Gaillard' (1829); 'Tombeaux de la Cathédrale de Rouen' (1838); 'Essai sur l'Exil d'Ovide' (1859); and his monumental 'Histoire de l'Art de la Verrerie dans l'Antiquité' (1874).

DE VILLIERS, dė vil'yērz, **John Abraham Jacob,** Anglo-Dutch geographer: b. London, 23 Sept. 1863. He is the son of a Hollander who settled at Prince Albert, Cape Colony. He was educated at the City of London College. He assisted at the Foreign Office as expert in Dutch in preparing evidence for the boundary arbitration with Venezuela in 1896-99; acted similarly in Dutch and Portuguese in the boundary arbitration with Brazil in 1901-04. He was engaged in researches for the Foreign Office in Lisbon 1901, at Berlin 1902, and at other places. In 1911 he lectured in Dutch throughout Holland. He is superintendent of the map room in the British Museum, is acting commercial attaché at The Hague and honorary secretary of the Hakluyt Society. His publications include 'Famous Maps in the British Museum'; 'Holland and Some Jews'; 'Objects of Jewish Interest in the British Museum'; 'The Transvaal'; translations of Lepelletier's 'Madame Sans-Gêne'; Gaulot's 'Chemises rouges'; Bourget's 'Mensonges'; Biré's 'Journal d'un Bourgeois de Paris'; Richard Schomburgk's 'Reisen in Britisch Guiana,' and other early works on Guiana. He is also author of various articles in the 'Encyclopædia Britannica.'

DEVIL'S ADVOCATE. See ADVOCATE.

DEVIL'S APRON, brown algæ, of the order *Laminariales,* usually called kelp. See ALGÆ; PHÆOPHYCEÆ.

DEVIL'S BIBLE, The, the popular name of a manuscript Bible written on ass-skin. The name arose from a legend that the writing was the work of a man who, by the Devil's help, accomplished it in a few hours in order to save his life, but who in return became the slave of the Evil One. After the Thirty Years' War it was taken to Stockholm.

DEVIL'S-BIT, the common name of a species of scabious (*Scabiosa succisa*), of the natural order *Dipsaceæ.* It has nearly globular heads of blue flowers, ovate leaves and a fleshy root, which is, as it were, cut or bitten off abruptly. In America devil's-bit is one of the

common names of *Lacinaria spicata*, which is known as dense button snakeroot, gay feather, backache-root, colic-root, etc. It belongs to the *Compositæ*, and is found in moist soil from Massachusetts to Florida and westward to Wisconsin and Louisiana.

DEVIL'S BRIDGE, (1) an ancient bridge in Cardiganshire, Wales; it crosses the ravine through which flows the Mynach. (2) A bridge in Switzerland, crossing the Reuss, on the road over Saint Gothard, from Germany to Italy.

DEVIL'S CLAW, a stout split hook at the end of a hawser or chain, for manipulating the chain cable in mooring, etc. A firm grip is obtained by slipping one claw on each side of one link, so that the next link is held at right angles to it. A capstan serves to secure the hawser.

DEVIL'S CLUB. See ARALIA.

DEVIL'S COACH-HORSE (*Deypus oleus*), a common British and European beetle belonging to the family *Staphylinidæ*. It has very much reduced wing-covers and like many of its relatives has the habit of curving its body upward, to adjust the wings under their covers.

DEVIL'S DARNING-NEEDLE. See DRAGON-FLY.

DEVIL'S DYKE, (1) an earthwork in Cambridgeshire, England, of prehistoric construction, about 20 feet in height. It is supposed to have been erected as a defense against enemies advancing from the Fen country. It extended from the fens or marshes to the wooded hills and thus closed the only way of approach from the interior towns of England, and prevented raids upon whatever band of conquerors held the country near the sea. (2) A natural formation near Brighton, England. The old legend said this was the work of the "good spirits," who thus prevented the devil's attempt to flood the country because the people had abandoned paganism.

DEVIL'S-FINGER, a name sometimes applied to the starfish (q.v.).

DEVIL'S ISLAND (ISLE DU DIABLE), a small rock formation off the coast of French Guiana, belonging to France. The area is about 16 square miles and the island itself is sandy, dry and torrid. Here Alfred Dreyfus was imprisoned for alleged treason.

DEVIL'S LAKE. See MINNEWAUKON.

DEVIL'S PARLIAMENT, a nickname for an English parliament which met in 1459 at Coventry. The Parliament, under the control of Henry VI, at his instigation unjustifiably proscribed and attainted for treason the Duke of York and his adherents.

DEVIL'S PUNCH-BOWL, Ireland, a lake near the summit of Mangerton Mountain in the vicinity of the Lakes of Killarney. It is between 2,000 and 3,000 feet above the level of the sea, and is supposed to be the crater of an ancient volcano. It is about half a mile in length and one-third in breadth.

DEVIL'S RIDING HORSE. See PIRATE BUG.

DEVIL'S SLIDE, Utah, a formation of the Wasatch Mountains, consisting of a natural arrangement of parallel crags resembling an inclined plane. The accidental juxtaposition of two such boulder masses is accounted for by the simultaneous action of a cooling atmosphere on liquefied masses. Nearby is the railway station and village of Devil's Slide. Pop. 200.

DEVIL'S THOUGHTS, or **DEVIL'S WALK, The**, a doggerel of 14 stanzas written jointly by Coleridge and Southey in 1799 and republished in the former's 'Sibylline Leaves' (1817). It may also be found in Southey's poems with additional verses referring to Porson.

DEVIL'S TOWER, a huge shaft of columnar igneous rock on bank of Belle Fourche River, 25 miles northeast of Moorcroft, Wyo. Visible from Chicago, Burlington and Quincy Railroad. It was made a United States National monument 4 Oct. 1915. Greatly venerated by Sioux Indians as the "Bad god's tower." It is 600 feet high and rises from a platform 600 feet above the river; diameter at top 325 to 375 feet. The columns are an exceptionally fine example of prismatic structure which some igneous rocks assume in cooling, notably Palisades of Hudson and Giants Causeway. Described by Newton, Jaggar, and Darton, in reports of United States Geological Survey.

DEVIL'S WALL, an ancient fortification in the southern part of Germany, about 368 miles long. This wall was originally a Roman ditch, with palisades behind it. It was intended to protect the Roman settlements on the left bank of the Danube, and on the right bank of the Rhine, against the inroads of the Teutonic and other tribes. Remains of it are found at present only from Abensberg, in Bavaria, to Cologne. As to the time when this rampart was built our information is very scanty. Some parts of the northern Roman fortifications may be as old as the time of Drusus. The Decumat or Tithe Lands, however; that is, the lands to the east of the Rhine and north of the Danube, which the Roman emperors allowed immigrants to settle on, on condition of paying tithes to the state, do not appear to have had any protecting wall about 14 B.C. The main rampart, stretching southward from the Main to the Danube, was probably completed under Hadrian, and parts of it which had been destroyed seem to have been restored by Probus. All the parts of this great rampart are still far from being thoroughly investigated.

DEVINE, Edward Thomas, American social worker; b. Union, Hardin County, Iowa, 6 May 1867. He was graduated at Cornell College, Iowa, in 1887. He was for some years a principal of schools in Iowa; in 1891–96 he was staff lecturer on economics for the American Society for the Extension of University Teaching; and was secretary of the Society in 1894–96, when he was appointed general secretary of the Charity Organization Society of New York. He was editor (from 1897 to 1913) of *Charities*, a paper later published as *Charities and the Commons*, and after 1909, as the *Survey*. In 1905 he was called to the chair of social economy in Columbia University. He was director of the New York School of Philanthropy in 1904–07 and again after 1912. He was president of the National Conference of Charities and Corrections in 1906, and as special representative of the American Red Cross had charge of relief at San Francisco after the

fire and earthquake in April 1906. He was in charge of storm and flood relief in Dayton, Ohio, in 1913. He has been connected with various congresses and organizations interested in social betterment. His published works include 'Economics' (1898); 'The Practice of Charity' (1901; new ed., 1904); 'The Principles of Relief' (1904); 'Efficiency and Relief' (1906); 'Misery and Its Causes' (1909); 'Report on the Desirability of Establishing an Employment Bureau in the City of New York' (1909); 'Social Forces' (1909); 'The Spirit of Social Work' (1909); 'The Family and Social Work' (1912); 'The Normal Life' (1915).

DEVINS, John Bancroft, American clergyman and editor: b. Brooklyn, N. Y., 1856; d. 1911. He was graduated from New York University in 1882, and was on the staff of the New York *Tribune* from 1880 to 1888. In the latter year he was ordained to the Presbyterian ministry and thereafter until 1905 held various pastorates in New York city. From 1890 until 1911 he was managing editor of the New York *Observer*. He organized the Federation of East Side Workers and the New York Employment Society. He was a collaborator in the 'Life of Dwight L. Moody' and published 'The Church and the City Problem' (1905); 'An Observer in the Philippines' (1905); 'On the Way to Hwai Yuen' (1905); 'The Classic Mediterranean' (1910), and several hymns.

DEVISE, dę-vīz', a gift of real property by a person's last will and testament. The term devise technically and properly only applies to real estate; the object of the devise must therefore be that kind of property. The word, however, is sometimes improperly applied to a bequest or legacy. In regard to a lapsed devise, where the devisee dies during the life of the testator, although there may be a residuary devisee, the estate will go to the heir. But if the devise be void, as where the devisee is dead at the date of the will, or is made upon a condition precedent which never happens, the estate will go to the residuary devisee, if the language is sufficiently comprehensive (4 Kent Com., 541, 542, and cases cited in notes). But some of the cases hold in that case, even, the estate goes to the heir (4 Ired. Eq., N. C., 320; 6 Conn., 292). In England a residuary bequest operates upon all the personal estate which the testator is possessed of at the time of his death, and will include such as would have gone to pay specific legacies which lapse or are void. A general devise of lands will pass a reversion in fee, even though the testator had other lands which will satisfy the words of the devise, and although it be very improbable that he had such reversion in mind. A general devise will pass leases for years, if the testator have no other real estate upon which the will may operate; but if he have both lands in fee and lands for years, a devise of all his lands and tenements will commonly pass only the lands in fee simple. But if a contrary intention appear from the will, it will prevail. A devise in a will can never be regarded as the execution of a power, unless that intention is clear, as where otherwise the will would have nothing on which it could operate. But to have that operation the devise need not necessarily refer to the power in express terms. But where there is an interest on which it can operate, it shall be referred to that, unless some other intention is obvious. The devise of all one's lands will not generally carry the interest of a mortgagee in premises, unless that intent is apparent. Devises are contingent or vested after the death of the testator; contingent, when the vesting of any estate in the devisee is made to depend upon some future event, in which case if the event never occur, or until it does occur, no estate vests under the devise. But when the future event is referred to merely to determine the time at which the devisee shall come into the use of the estate, this does not hinder the vesting of the estate at the death of the testator.

DEVIZES, England, a municipal borough in the county of Wilts, 86 miles west of London. It is the seat of a large corn market, and has cheese and bacon factories. The chief manufactures are steam-engines, boilers, gas-engines and beer. Pop. 6,739.

DEVON, a river of Scotland, which has its source at the foot of the Ochill Hills, and flows into the Forth about two miles above Alloa. Its length is 34 miles. Below the Crook of Devon are a series of cascades, the most noted of which are the Caldron Linn and those at the Rumbling Bridge.

DEVONIAN. The name Devonian appeared in geological literature in 1839, when Murchison and Sedgwick applied it to a rock system in Devonshire and Cornwall, England, consisting of conglomerates, shales and fossiliferous limestones lying below the Carboniferous rocks and above the great mass of the graywacke or transitional series of Werner, that was already included in the Cambrian or Silurian. Murchison and Sedgwick also included in the Devonian the Old Red Sandstone of Scotland. The Devonian Period is that part of Paleozoic time following Silurian and preceding Carboniferous. At the beginning of the period, the seas were greatly restricted in North America, much as they were in the late Silurian (q.v.). Embayments existed on the present site of the Appalachians, and perhaps somewhat farther west. An arm of the Pacific also covered part of the Great Basin and other smaller embayments probably covered various areas. For the most part, however, the United States was land. By the middle of the period another great interior sea had encroached over a large part of central North America. Europe was also largely submerged in mid-Devonian. In Scotland and Wales were landlocked seas or lakes, and there were others in western Russia. A large part of central South America was covered by water. Fossil evidence indicates that in early Devonian there were land connections between North and South America and between South America and South Africa. Volcanic activity was extensive in western Europe, in New England and probably in California. Some folding took place in northeastern North America, probably near the middle of the period. The rocks of the Devonian System in North America have been variously subdivided. H. F. Cleland (1916) gives the following as the New York type section, beginning with the lowest formations: Helderberg limestone, Oriskany sandstone, Onondaga limestone, Marcellus shale, Hamilton shale, Tully limestone, Genesee shale, Portage shale and sandstone, Catskill and

Chemung sandstones. Where the line between the Silurian and Devonian systems should be drawn in North America is still a matter of dispute, the lower Helderberg formation being variously assigned to the Silurian and to the Devonian. In eastern United States Devonian rocks outcrop extensively in New York and southward throughout the Appalachian Mountains and plateaus. In the central Mississippi Valley Devonian is present but very thin. In Manitoba and the Northwest Territory, Canada, the Devonian System includes limestones and shales and is of moderate thickness. There is an area of Devonian rocks extending along the Rocky Mountains from Montana across Alberta. In the United States the Devonian rocks of the Rocky Mountains appear in Colorado and Arizona.

In England and on the Continent the Devonian System presents two different classes of rocks: (1) the Old Red Sandstone, occurring in Scotland, in South Wales and across the Welsh border in England, also in the Baltic provinces of Russia and in Spitzbergen; (2) the marine Devonian, occurring in southwest England, in northern and southern France, in Spain and over large areas in Germany and central Russia. The Old Red Sandstone was laid down perhaps in shallow seas either closed or having only slight connection with the open ocean — perhaps in part on land in desert areas. The formation is of interest from its containing remains of Devonian land animals and plants. The rocks are fine-grained conglomerates, sandstones and shales. The marine Devonian of Europe is largely limestone, with some shales and slates.

Devonian rocks in Asia are found over a vast area in Siberia and also occur in China and in Asia Minor. In Africa they are found both in the northern and southern parts of the continent. In South America Devonian rocks form a great system, being found in Brazil, Bolivia and the Falkland Islands.

The vegetable and animal life of Devonian time, so far as can be determined, did not differ greatly from Silurian forms, though it shows a general advance toward more highly developed types. The land vegetation included cryptogams and gymnosperms. Of the cryptogams the tree-ferns and the giant club-mosses (*Lepidodendra*) must have been conspicuous in the forests, being over 50 feet high. Of the gymnosperms, cycads, now almost extinct, were abundant, and it is possible that conifers of the yew family grew upon the higher ground.

Of animal life the trilobites, so abundant in Cambrian and Silurian time, were less important, but other crustaceans developed greatly, including the eurypterids, related to the horseshoe crabs. Corals were very abundant in the Devonian oceans. Crinoids, or sea-lilies, and starfish were more abundant than in Silurian time. The brachiopods, or lamp shells, apparently were, as in Silurian, the most abundant elements of marine life. Of mollusks there were bivalves and gastropods; the ammonites appeared among the cephalopods and nautilus-like forms were less abundant than in the Silurian. The chief characteristic of Devonian time, however, was the great development of the fishes, the Devonian being known as the «age of fishes.» Many of the Devonian forms, however, have long been extinct, while the teleosts, or bony fishes, which include by far the greater part of modern fishes, evidently did not exist at all in Devonian time. Among the old Devonian forms were the ostracodermata, fish-like animals allied to the lampreys, but having the head and sometimes a large part of the body covered with bony plates. Of the true fishes the selachians, or sharks, were represented, as were the dipnoi or lung fishes, now almost extinct. The most highly developed Devonian fishes were the ganoids, now represented by the sturgeon and the gar-pike. (See CATSKILL GROUP; CHEMUNG STAGE; CORNIFEROUS STAGE; HAMILTON STAGE; MARCELLUS STAGE; PORTAGE STAGE; OLD RED SANDSTONE; ORISKANY STAGE). Consult Clarke, 'Early Devonian History of New York and Eastern North America,' in New York State Museum, Memoir 9 (2 parts, Albany 1908–09); Chamberlain and Salisbury, 'Geology' (Vol. II, New York 1907); Dana, 'Manual of Geology' (4th ed., ib. 1896); Geikie, Archibald, 'Text-Book of Geology' (London 1903); Leconte, 'Elements of Geology'; Williams, "The Devonian and Carboniferous," in 'Bulletin 80,' United States Geological Survey (Washington 1891); "Devonian," in 'Maryland Geological Survey Reports' (3 vols., Baltimore 1913); Zittel, K. A. von, 'History of Geology and Paleontology' (Munich 1899).

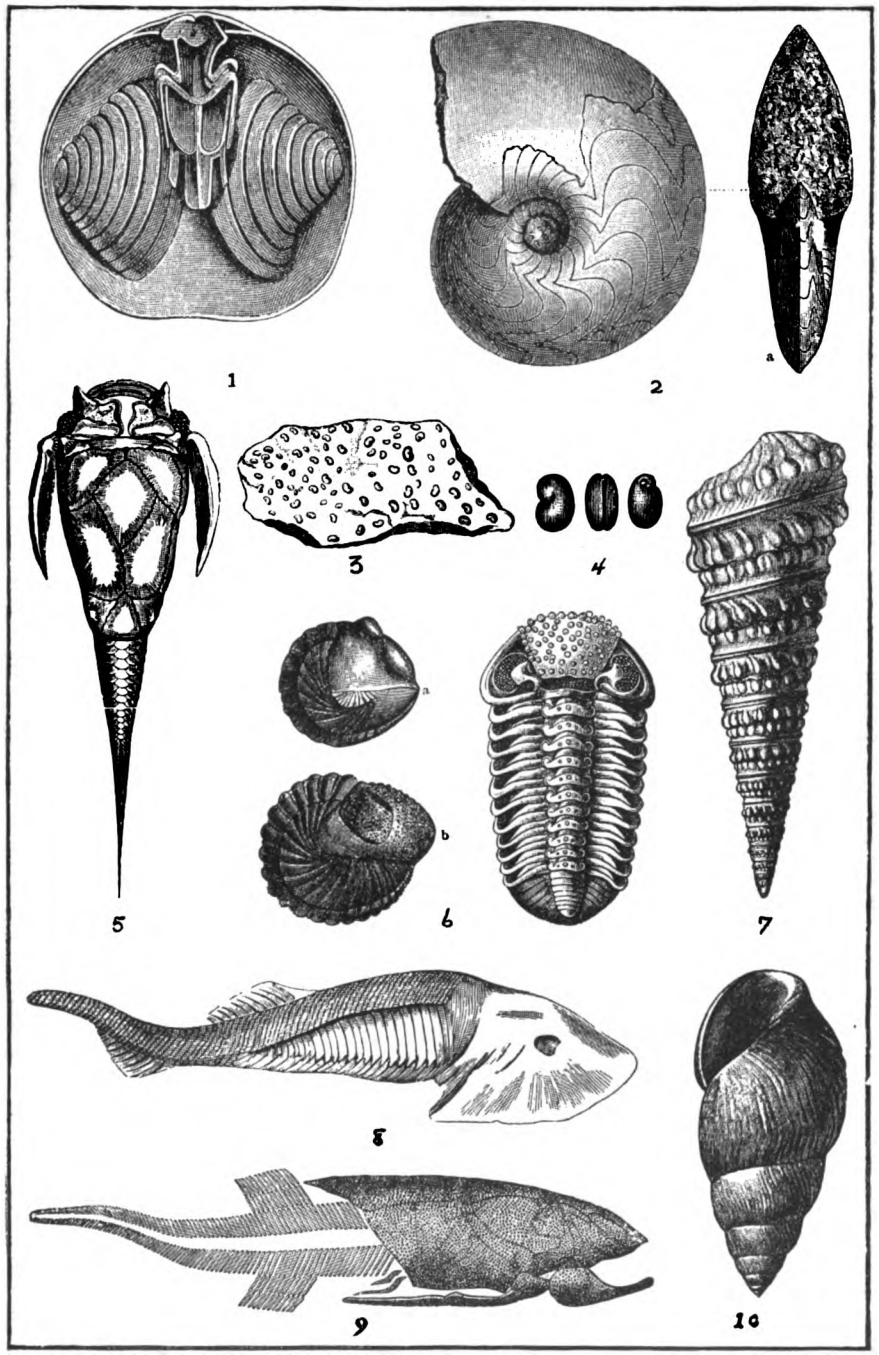
C. L. DAKE.

DEVONPORT (before 1824 called **PLYMOUTH DOCK**), England, a parliamentary borough, maritime town and naval arsenal, in the southwest of Devonshire. It forms one of the Three Towns of Plymouth, Stonehouse and Devonport. It owes its existence to the dockyard established here by William III in 1698, which is now one of the chief naval arsenals in Great Britain, largely extended so recently as 1907, and now covering an area of 240 acres. There is an important naval engineering college. Trade centres almost entirely in the dockyard and its subsidiary industries. The borough returns two members to Parliament. Pop. 81,678.

DEVONS, the name given to a breed of cattle which were first bred in Devonshire, England. They are rather wild, of a dark-red color, and can be used instead of horses for plowing. They are smaller than Shorthorns or Herefords. The bull has a small head, fine muzzle and face, very handsome horns, which should taper upward and rather backward; the eye is large and rather wild, indicating an active disposition; the neck is arched, but the dewlap is not much developed; tail set on rather high; good barrel well up behind the shoulder; not the depth of carcass in the same height as is found in the Shorthorns; skin of a dark-red and rather mottled character, and plenty of long curling hair; the skin is thicker than that of Shorthorns, but not so thick as that of Herefords. They furnish a good deal of inside fat and firm meat, and the cows yield very rich milk from which the famed Devonshire clotted cream is made. They are hardy, and able to find food on poor uplands. See CATTLE.

DEVONSHIRE, Spencer Compton Cavendish, 8TH DUKE OF, English statesman: b. 23 July 1833; d. Cannes, France, 24 March 1908. He succeeded to the ducal title in 1891, having

DEVONIAN FOSSILS



1 A Brachiopod (Athyris concentrica); interior of dorsal valve, showing spiralia
2 An Ammonite (Goniatites intumescens); a lateral view
3 Hulls of fossil Entomostracans (Cyprididae) in a slab of schist
4 Shells of the same (Cypridina serratostriata)
5 An Armored Fish (Pterichthys cornuta)
6 A Trilobite (Phacops latifrons), shown in *a* and *b* rolled up
7 A Gasteropod Mollusc (Murchisonia bigranulosa)
8 A Great Armored Fish (Cephalaspis lyelli); restored
9 The Berry-bone Fish (Coccosteus decipiens); restored
10 A Gasteropod Mollusc (Macrocheilus subcostatus)

previously become well known by his courtesy title of the Marquis of Hartington. First returned to the House of Commons in 1857, he was appointed Under-Secretary for War in 1863, and Secretary of State for War in 1866. In the course of the American Civil War, he visited the United States, and had interviews with both Jefferson Davis and Abraham Lincoln, the latter of whom predicted his rise to eminence. He was Postmaster-General under Gladstone 1868–70, and Chief Secretary for Ireland 1870–74. After Mr. Gladstone's retirement from the Liberal leadership in 1875, he acted as chief of the opposition, again giving place to his old leader after the Liberal triumph of 1880. He was Secretary for India 1880–82, and became Secretary of State for War 1882–85. After 1886 he was an active and influential leader of the Liberal Unionists, and under a Unionist ministry was Lord President of the Council 1895–1903, retiring when the Tariff Reform issue was raised by Chamberlain, and devoting himself thenceforth to a defense of free trade policy. He was chancellor of Cambridge University, 1892–1908. Devonshire held a unique place in British public life. He was not brilliant or witty; he was no orator; he was perfectly indifferent to applause; his "you-be-damnedness" was proverbial; but his high sense of duty, his transparent candor and sincerity, his plain, practical common sense, and the singular impartiality with which he approached public questions, drew to him that great body of moderate opinion which is so powerful in England. Thrice he refused the premiership; he had no ambitions for himself; and his opposition to both Home Rule and Tariff Reform did much to harden public opinion against these measures.

DEVONSHIRE, the third largest county in England, situated in the southwest. It is famous for its Old Red Sandstone (see DEVONIAN). This county contains the barren tract of Dartmoor and also the valley of the Exe, called "The Garden of Devonshire." Area, 1,671,364 acres. Three-fourths of the county is arable land or in pasture; the coast is rugged and precipitous; the climate mild and salubrious. It is celebrated for its orchards and dairy farms. The mineral wealth includes lead, copper, tin, iron, slate, marble, granite and limestone. Lace, coarse woolens and linens are among the manufactures. The fisheries are important and valuable. For parliamentary purposes, the county is divided into eight divisions, each returning one member. The principal towns are Exeter (the capital), Plymouth and Barnstaple. Pop. 699,703.

DEVONSHIRE CLUB, a Liberal club, founded on Saint James's street, London, in 1875.

DEVONSHIRE HOUSE, the London residence of the dukes of Devonshire, situated in Piccadilly, near Berkeley Square. It contains the "Kemble Collection of Plays," including the first editions of Shakespeare, also priceless collections of gems, portraits, etc.

DE VRIENDT, dę vrēnt', **Frans** (also known as FLORIS, F.), Flemish painter of the Renaissance: b. Antwerp, about 1517; d. 1570. His father was a stonecutter and Frans at first studied sculpture and later painting under Lambert Lombard at Liége. He paid a visit to Rome in order to study the works of Michelangelo and Raphael. In 1540 he returned to Antwerp, opened a school and is reputed to have there instructed 120 pupils. He was successful in obtaining the patronage of William of Orange and others of the nobility. He decorated the homes of many of the first citizens of Antwerp and in 1549 and 1556 had charge of the decorations for the reception of Philip II. The best of his portraits is 'The Falconer,' in the museum of Brunswick. Other pictures characteristic of his mannered style are 'The Last Judgment,' in the Brussels Museum; 'Lot and his Daughters,' in the Dresden Gallery; and 'The Fall of the Rebellious Angels,' in the Antwerp Museum.

DEVRIENT, dę-vryān', **Gustav Emil,** German actor: b. Dresden, 4 Sept. 1803; d. there, 7 Aug. 1872. He was a nephew of Ludwig Devrient (q.v.), and brother of Philipp Eduard Devrient (q.v.). He began his career by engaging in a manufacturing business, but soon followed the family penchant for the theatre, making a successful début as Raoul in Schiller's 'Jungfrau von Orleans' at Brunswick in 1821. In 1825 he married the popular actress, Dorothea Böhler, in Leipzig. He played prominent rôles in Magdeburg and Hamburg, and in 1831 established that connection with the Court Theatre of Dresden which lasted for the rest of his life. In his rôle of Hamlet he had no peers, and was considered by his contemporaries as fine an artist as Kean. Posa, Tasso and Uriel Acosta were among the rôles in which he scored the greatest success.

DEVRIENT, Ludwig, German actor, first of the noted actor-family of this name: b. Berlin, 15 Dec. 1784; d. there, 30 Dec. 1832. He engaged in commerce at the advice of his father, but in 1804 joined a traveling dramatic company. His début was made in Schiller's 'Braut von Messina' at Gera. He was engaged at Dessau in 1805 and in 1809 went to Breslau. In 1815, for the first time he appeared in Berlin as Franz Moor in Schiller's 'Räuber.' His best rôles were as Talbot, Schewa, Lorenz Kindlein, Shylock, Lear, Richard III and Mercutio. He was remarkable for his originality and interpreted both humorous and tragic parts with equal skill, having a natural aptitude and deftness. His fondness for society led to dissipation and a consequent early death. Consult Funck, 'Aus dem Leben Zweier Schauspieler, Ifflands und Devrients' (Leipzig 1838).

DEVRIENT, Otto, German actor and dramatist, son of Philipp Eduard Devrient (q.v.): b. Berlin, 3 Oct. 1838; d. 23 June 1894. In 1856 he made his début at Karlsruhe, was subsequently engaged in Stuttgart, Berlin and Leipzig; returned to Karlsruhe in 1863, where he remained for 10 years. In 1873 he became the manager of a theatre in Weimar, and subsequently held similar positions at Mannheim and Frankfort. He removed to Jena in 1879 and there produced his 'Luther' in 1883. In 1884 he was made director of the Court Theatre in Oldenburg and in 1889 was appointed to a similar post in Berlin, from which he retired the following year. He wrote several dramas, including 'Zwei Könige' (1867); 'Tiberius Gracchus' (1871) and 'Kaiser Rotbart' (1873). Other works of his are 'Zwei Shakespeare-

Vorträge' (1869), and an edition of letters of Iffland and Schröder (1881).

DEVRIENT, Philipp Eduard, German actor and dramatist, brother of Gustav Emil Devrient (q.v.): b. 1801; d. 1877. He made his début as an opera singer in Berlin in 1819, but in 1835 turned his attention to the drama and for a time was manager of the Dresden Theatre. From 1852 to 1870 he was director of the Karlsruhe Theatre. His writings include the libretto for the opera 'Hans Heiling' (1827); the plays, 'Das graue Männlein,' 'Die Gunst des Augenblicks' (1833); 'Die Verirrungen' (1837) and 'Treue Liebe' (1841); and also a number of works on dramatic history and criticism of which the best known is 'Geschichte der deutschen Schauspielkunst' (1848–74).

DE VRIES, dę-vrēs', David Pieterszen, Dutch colonist in America. Nothing definite is known as to the dates of his birth and death. He was a member of a company organized in 1630 to settle the tract of land in the present State of Delaware, which had been bought in 1629 from the Dutch West India Company by Samuel Blommaert and Samuel Godyn. On his arrival 1632 he found that the colony founded 1631 on Lewes Creek, Cape Henlopen, and called with the surrounding country «Swaanendael,» had been completely destroyed by the Indians. He left some of his party there and visited Virginia, but took the colonists back to Holland in 1634. Later he visited Manhattan several times and tried to found a colony on Staten Island, which the Indians destroyed in 1640. He also lived on a plantation called Vriessendael, on the site of Tappan, N. Y. He published 'Korte historiaal ende Journaels Aenteyckeninge van verscheyden Voyagien in der Vier Teelen des Wereldts Ronde' ('A short history and notes of a journal kept during several voyages in the four parts of the world,' 1655). Parts of it have been translated and may be found in 'Collections of the New York Historical Society' (Vols. I and II, second series).

DE VRIES, Hugo, Dutch botanist: b. Haarlem 1848. He received his education at Leyden, Heidelberg and Würzburg. In 1871 he began his life-long connection with the University of Amsterdam, first as lecturer and then as professor of botany. His research had bearing on the development of the theory of mutation and the results of his study were the most significant addition to the principle of organic evolution since the enunciation of the theory of natural selection. De Vries has been eminently successful in changing the method of studying evolution from observation to experimental work, and, in all probability, herein lies his great contribution to modern science. His publications include 'Intracellular Pangenesis' (1889); 'Die Mutationsthtorie' (1903); 'Plant Breeding' (Chicago 1907).

DE VRIES, Marion, American lawyer: b. near Woodbridge, San Joaquin County, Cal., 15 Aug. 1865. He was graduated from the San Joaquin Valley College in 1886 and from the law school of the University of Michigan in 1888. He practised law at Stockton, Cal., 1889–1900; was assistant district attorney of San Joaquin County in 1893–97, and was admitted to practice before the Supreme Court of the United States in 1897. From 1897–1900 he was a member of the United States House of Representatives. He became a member of the United States Board of General Appraisers, New York, 1900, and president from 1906–10. He resigned then, to accept the appointment of associate judge of the United States Court of Customs Appeals.

DEW, Thomas Roderick, American publicist: b. King and Queen County, Va., 5 Dec. 1802; d. Paris, France, 6 Aug. 1846. He was graduated from William and Mary College, and in 1827 was elected professor of political economy, history and metaphysics; and in 1836 was made president of that institution. In 1829 he published his 'Lectures on the Restrictive System.' It was brought out at a moment when feeling ran high on the subject of the tariff, between protectionists and free-traders; and though emanating from the closet of a thinker removed from the agitations of political warfare, took a strong hold on the public mind, and the subsequent adoption of the compromise of 1832 may be attributed in part to its silent influence. His 'Essay in Favor of Slavery' did much to decide Virginia's attitude. His most elaborate work was 'A Digest of the Laws, Customs, Manners and Institutions of the Ancient and Modern Nations' (1853).

DEW, a deposition of moisture after sundown upon the surface of the earth. Three concurrent sources of dew are recognized: (1) the condensation of the moisture of the atmosphere; (2) the condensation of watery vapor arising from the earth; and (3) the moisture exhaled by plants. Regarding the first of these sources, it is a well-known fact that warm air has a larger capacity for moisture than cooler air. Given a certain degree of humidity the falling of the temperature of the air after sundown will so reduce its absorptive capacity for the moisture that some of it will be condensed on objects colder than itself. Secondly, humid vapor rising warm from the warm soil comes in contact with the cooling strata of the atmosphere already depositing moisture and gives up its superabundance. In the third place, the grass, flowers and foliage which, under the action of plant life in sunlight have been evaporating into the atmosphere the water absorbed by the roots to liquefy the sap so that it may be raised to the growing parts of the plant, continue this process until a balance is obtained between the temperatures at the roots and at the tips of the leaves. In some kinds of trees this exhalation of moisture is very large and the dew thus formed may be heard dripping from the trees all night long. Most of the large, sparkling dewdrops seen on herbage in the early morning is this third form of dew. When the temperature of the lower air strata drops to 32° F., the dew is deposited as hoarfrost. When the sky is clouded the heat abstracted from the earth's surface by radiation is returned by the clouds, which, being good radiators, transmit an equal amount of heat to what they receive; and a balance of temperature being thus maintained between the earth and the surrounding atmosphere, no dew is formed. The deposition of dew is likewise prevented by wind, which carries away the air before the vapor has been condensed. Horizontal surfaces, and those which are ex-

posed to a wide expanse of sky, receive a greater supply of dew than sheltered or oblique surfaces, where circumstances diminish the amount of radiation.

An acquaintance with the cause which produces dew and hoarfrost enables us to understand the rationale of the process resorted to by gardeners to protect tender plants from cold, which consists simply in spreading over them a thin mat or some flimsy substance. To ensure the full advantage of this kind of protection from the chill of the air, the coverings should not touch the bodies they are intended to defend.

The heavy dews which form in tropical regions are in the highest degree beneficial to vegetation, which, but for this supply of moisture, would, in countries where scarcely any rain falls for months, be soon scorched and withered. But after the high temperature of the day the ground radiates under these clear skies with great rapidity, the surface is quickly cooled, and the watery vapor, which, from the great daily evaporation, exists in large quantities in the atmosphere, is deposited abundantly. This deposition is more plentiful also on plants, from their greater radiating power; while on hard, bare ground and stones, it is comparatively trifling. In cold climates the clouds, which are so common in damp and chilly regions, prevent the radiation of heat: the surface is thus preserved warm, and the deposition of dew is, in a great measure, prevented. Consult Martin, E. A., 'Dew Ponds' (London n.d.).

DEWALQUE, dę-vąlk', **Gilles Joseph Gustav,** Belgian geologist: b. Stavelot 1826; d. 1905. In 1855 he was made curator of the mineralogical and geological cabinet at the University of Liége, and became professor there of mineralogy, geology and palæontology in 1857. In 1870 he became president of the Belgian Academy. He wrote 'Description du Lias dans le Luxembourg' (1857); 'Atlas de Cristallographie' (1860); 'Prodrome d'une Description géologique de la Belgique' (2d ed., 1880); and numerous contributions to scientific periodicals.

DEWAR, Sir **James,** British chemist: b. Kincardine-on-Forth, Scotland, 1842. He was educated at Edinburgh University and became assistant to Lord Playfair who at that time was professor of chemistry there. He was afterward Jacksonian professor of experimental philosophy at Cambridge and Fullerian professor of chemistry in the Royal Institution. He was made president of the Chemical Society in 1897 and of the British Association in 1902. He was knighted in 1904. He has done extensive research work in regard to the physiological action of light and the liquefaction of gases and in the study of low temperatures. By evaporating liquid hydrogen under reduced atmospheric pressure he obtained the lowest temperature yet reached (470° F. of frost). Other inventions consummated by Dewar are cordite (with Sir Frederick Abel), a smokeless powder; and vacuum containers for keeping foods at any desirable temperature, to which the name thermos bottles has been given.

DEWART, Edward Hartley, Canadian clergyman and editor: b. County Cavan, Ireland, 1828; d. Toronto, Ontario, 1903. His parents emigrated to Canada in 1834, settling in Ontario. He received his education at the Normal School, Toronto, and in 1855 became a Wesleyan Methodist minister. He afterward held a number of pastorates and became editor of the *Christian Guardian,* the principal Methodist publication in Canada, and held this position until 1894. He was forceful as an editor, was not narrowly orthodox, although he took some flings at the higher critics. He was a great factor in bringing together the various Methodist denominations of Canada (Wesleyan Methodist, Methodist Episcopal, New Connexion, Bible Christian and Primitive Methodist), the first meeting of the delegates being held in his home. In 1883 the union of the churches was brought about, but not on the platform suggested by Dewart. Nevertheless, he bent his best energies toward making it effective. He was successful in bringing about the federation of Victoria University with the provincial University of Toronto. He was liberal in politics and by his independent action in these matters often excited strong prejudice among his religious followers. He was a delegate to the Ecumenical Methodist conferences of 1881 in London and of 1891 in Washington. He aided in editing and compiling a new hymnbook for the Methodist Church. He published 'Selections from the Canadian Poets' (1864); 'Songs of Life' (1869); 'Jesus the Messiah' (1892); 'Essays for the Times' (1898); 'Outlines of Christian Doctrine' (1899).

DEWAS, dā-wäs', India, two native states in the Malwa Political Charge of central India, founded in the first half of the 18th century by two brothers, Punwar Mahrattas, who came into Malwa with the peshwa, Baji Rao, in 1728. Their descendants are known as the senior and junior branches of the family, and since 1841 each has ruled his own portion as a separate state, though the lands belonging to each are so intimately entangled that even in Dewas, the capital town, the two sides of the main street are under different administrations and have different arrangements for water supply and lighting. The senior branch has an area of 446 square miles and a population of 62,312, while the area of the junior branch is 440 square miles, and its population 54,904. Grain, opium, sugarcane and cotton are the chief products. Dewas, the capital, is the residence of both chiefs, and near it, on a conical hill, is a temple. Its population is about 15,100.

DEWBERRY, *Rubus villosus,* or *Rubus canadensis,* a trailing plant of the natural order *Rosaceæ.* Its prickly stems, leaves and fruit resemble the blackberry. During the last quarter of the 19th century it became popular as a cultivated fruit, principally through the introduction of its variety, the *Lucretia,* which is superior to the wild forms common as weeds on wornout pastures and poor land. The plants, which are propagated by means of stem-tips, do best on a rather lighter soil than the blackberry, like which, with the exception of training, it is cultivated and fertilized. They are usually trained to stakes or trellises and not given summer pruning, except in the removal of canes as soon as they are fruited. The usual distances for planting are three or four feet by six. The fruits ripen considerably in advance of the blackberries. See Blackberry; Raspberry; Rubus.

DEWDNEY, Edgar, Canadian statesman: b. Devonshire, England, 1835. He studied civil engineering, and on removing to Canada was employed to lay out the town of New Westminster. He was elected to the legislature of British Columbia in 1869 and to the Dominion Parliament in 1872. In 1879 he was appointed Indian Commissioner and in 1881 Lieutenant-Governor of the Northwest Territory, holding the two offices until 1888, when he became Minister of the Interior. From 1892–97 he was Lieutenant-Governor of British Columbia.

D'EWES, dūz, Sir **Simonds,** British chronicler and antiquarian: b. Coxden, Dorsetshire, 18 Dec. 1602; d. 1650. He was educated by private tutors, early embraced Puritan theology from John Dickinson and in 1618 entered Saint John's College, Cambridge. In 1620 he was removed by his father to the Inner Temple and was called to the bar in 1623. He abandoned the law in 1626 and was knighted in the same year. Having married a rich heiress he now had leisure to devote himself to antiquarian studies which he pursued zealously even while serving as member for Sudbury in the Long Parliament. He was expelled in 1648. He collected a great number of manuscripts and made transcripts from monastic and other records; these transcripts now form part of the Harleian collection in the British Museum. D'Ewes's greatest work is his 'Journal of All the Parliaments of the Reign of Queen Elizabeth' (1629; edited and published for the first time by his nephew, Paul Bower, London 1682). It was incorporated by Cobbett in his 'Parliamentary History.' Consult Jessopp in the 'Dictionary of National Biography' (Vol. XIV, London 1888) and Halliwell-Phillips's edition of the 'Autobiography and Correspondence of Sir Simonds D'Ewes during the Reign of James I and Charles I' (London 1845).

DE WET, dā-vĕt', **Christiaan,** Boer general: b. Leeuwkop, Orange Free State (now Orange Free State Province), 7 Oct. 1854. He was bred a farmer, made a small fortune and became, in 1897, a member of the Volksraad. Though practically without military experience, he served ably in the Boer-British War of 1899–1902, attaining the rank of general and outwitting the pursuit of Kitchener and Roberts in the summer of 1900, and of the former in the early part of 1901. His surprise of the British at Sanna's Post was highly praised by military experts. With the other Boer generals he visited England after the conclusion of the war. His 'Three years of War' was published in 1902. In 1907 he became a member of the first Parliament of the Orange River Colony, and Minister of Agriculture. Taking advantage of the Great European War, he led an insurrection in October 1914, which, however, was promptly quelled; on 2 December he surrendered to General Botha, was condemned to six years' imprisonment and fined £2,000, but clemency was exercised and he was released.

DE WETTE, vĕt'tĕ, **Wilhelm Martin Leberecht,** German theologian: b. Ulla, near Weimar, January 1780; d. Basel, Switzerland, 16 June 1849. In 1807 he became professor of theology at Heidelberg, and in 1810 he was called to be the colleague of Schleiermacher at Berlin. In 1822 he accepted the chair of theology at Basel, where he remained till his death. The influence of De Wette's views upon the theological tendencies of his time was most important. He was a member of the council of education at the Grand Council of Basel, and in 1849 became rector at that university. He was remarkable for his critical acuteness and for his powers of concise and clear exposition. His works are very numerous. Among them are 'Beiträge zur Einleitung in das Alte Testament' (1806–07); 'Lehrbuch der historischkritischen Einleitung in die kanonischen und apokryphischen Bücher des Alten Testaments' (1817); 'Einleitung in das Neue Testament' (1826); 'Lehrbuch der hebräisch-jüdischen Archäologie' (1814); 'Kurzgefasstes exegetisches Handbuch zum Neuen Testament' (1836–48). These works are all more or less of a critical nature; in the following he developed his own theological views: 'Lehrbuch der christlichen Dogmatik' (1813–16); 'Christliche Sittenlehre' (1819); and the didactic novel, 'Theodor oder des Zweiflers Weihe' ('Theodore, or the Consecration of the Skeptic,' 1822). He translated the entire Bible into German in co-operation with J. C. W. Augusti. He edited the correspondence of Luther (Berlin 1825–28). Consult Cheyne, 'Founders of Old Testament Criticism' (London 1894).

DEWEY, Charles Melville, American painter: b. Lowville, N. Y., 16 July 1849. From his 12th to his 17th year he suffered from hip disease, an experience which tinged his later paintings with a rare poetic melancholy. He studied in the National Academy of Design, New York, 1874–76, and in Paris under Carolus-Duran, 1876–77. In 1878 he returned to New York. He has specialized in landscapes, both in oil and water color. He is represented in many public and private collections in the United States. Among his works dealing mostly with morning and evening subjects, are 'Indian Summer' (1904); 'A November Evening' (1904); 'Morning, Bay of Saint Ives' (1905); 'The Edge of the Forest,' in the Corcoran Gallery, Washington; 'The Harvest Moon,' and 'The Close of Day,' in the National Gallery, Washington; 'The Gray Robe of Twilight,' in the Buffalo Gallery; and 'Old Friends' in the Pennsylvania Academy, Philadelphia. In 1907 he became a National Academician.

DEWEY, Davis Rich, American political economist and statistician: b. Burlington, Vt., 7 April 1858. He is a brother of John Dewey (q.v.). He was educated at the University of Vermont and at Johns Hopkins University. He is professor of economics and statistics in the Massachusetts Institute of Technology, trustee of Massachusetts Agricultural College and managing editor of the *American Economic Review.* His works are 'Syllabus of Political History since 1815'; 'Report of Massachusetts Board to Investigate the Subject of the Unemployed' (1895); 'Report of Commission to Investigate the Public Charitable and Reformatory Interests and Institutions of the Commonwealth' (1897); 'Financial History of the United States' (1902); 'Employees and Wages' — Special Report 12th Census (1903); 'National Problems' (1907); articles in 'Cyclopedia of American Government,' edited by McLaughlin and Hart (1914).

DEWEY, George, American naval officer: b. Montpelier, Vt., 26 Dec. 1837; d. Washington,

D. C., 16 Jan. 1917. At 17, after a preparatory course in the Northfield Military School, young Dewey was appointed a cadet at Annapolis, in the class which was graduated in 1858. At the outbreak of the Civil War he was commissioned a lieutenant under Admiral Farragut and assigned to the sloop-of-war *Mississippi*. His first active experience in war was when the West Gulf squadron, early in 1862, forced a passage up the Mississippi River ahead of Farragut. A later enterprise resulted in the grounding of the *Mississippi*, in the middle of the night, while attempting to run the batteries of Port Hudson. Here she was riddled with shot and set afire by the enemy's batteries, so that officers and crew had to abandon her, and make their way as best they could to the other shore before the flames reached her magazine and she exploded.

Other notable engagements in which Dewey figured during the Civil War were at Donaldsonville in 1863, and at Fort Fisher in the winter of 1864–65, as an officer of the *Agawam*. Receiving his commission as lieutenant-commander in March 1865, he served for two years on the *Kearsarge* and the *Colorado*, and was then attached to the Naval Academy for two years more. In 1870 he was given command of the *Narragansett*, and during his five years' charge of her rose to be a commander. He was then attached to the Lighthouse Board, and in 1882 took his next sea duty in command of the *Juniata* of the Asiatic squadron. On reaching his captaincy, in 1884, he took charge of the *Dolphin*, one of the first vessels of the new navy. From 1885 to 1888 he commanded the *Pensacola*, then flagship of the European squadron; and this service was followed by shore duty, in the course of which he served as chief of the Bureau of Equipment at the Navy Department, and afterward on the Lighthouse Board for a second time. In 1896 he was promoted to commodore, and made president of the Board of Inspection and Survey. At the beginning of 1898, a few weeks before the outbreak of the Spanish-American War, he was placed in command of the Asiatic squadron, and was thus given the chance to distinguish himself which he so brilliantly improved.

With his squadron he left Mirs Bay, China, 27 April 1898, with orders to "capture or destroy the Spanish squadron," then supposed to be in Manila Bay, under command of Admiral Montojo. The squadron entered the channel of Manila at 11:30 P.M., Saturday, 30 April, and early on Sunday morning, 1 May, sank, burned or captured all the ships of the Spanish squadron in the bay, silenced and destroyed three land batteries, obtained complete control of the bay, so that he could take the city, the chief port of the Philippine Islands, at any time, and all without losing a single man, and having only nine slightly wounded. On 18 August Dewey and his ships aided General Merritt in the capture of Manila. In recognition of his Manila Bay achievement, Commodore Dewey received the thanks of Congress, which awarded to him a magnificent sword, and medals to his men. As a further recognition of his achievement, Commodore Dewey was (7 May 1898) promoted to be a rear-admiral, and subsequently (3 March 1899) made admiral of the navy under an act of Congress, approved 2 March 1899, restoring that rank for the especial purpose of enabling the country to honor adequately the hero of Manila Bay. To Dewey also was granted a great honor in that the government enacted a law whereby he was never to be placed on the retired list. Thus Admiral Dewey, though long past the age of retirement, was an active officer in the United States navy at the time of his death. In 1914 he came into great prominence again; the publication of his autobiography revived an incident at the battle of Manila Bay 16 years before. In writing about the battle Admiral Dewey told how a shot was fired across the bow of one of the German ships to impress Admiral von Diedrichs with the fact that the American navy had established a blockade and would countenance no undue activity on the part of the Germans.

"A difference of opinion about international laws had been adjusted," Dewey wrote, "without adding to the sum of President McKinley's worries."

A sharp attack by Herr Erzberger in the Reichstag followed the publication and Count Reventlow, the German naval writer, published a scathing article in the *Tages Zeitung*. Andrew D. White, who had recently returned from being Ambassador to Germany, in speaking of this incident said that von Diedrichs "conceived it his duty in a vague sort of way to butt in to protect German interests." In 1901 he was president of the Schley court of inquiry, and in the same year became president of the General Board of the Navy, which position he held until his death, and in 1902 was appointed commander-in-chief of the united squadrons and fleets mobilized for extraordinary manœuvres. Consult Clemen's 'Life of Dewey' (1899); 'Autobiography' (1914).

DEWEY, John, American philosopher and educator: b. Burlington, Vt., 20 Oct. 1859. He was educated at the University of Vermont and Johns Hopkins University, and has held the chair of philosophy in the universities of Michigan, Chicago and Columbia, having been connected with the last named institution since 1905. He has been president of the American Psychologic and American Philosophic Associations, and took an active part in the formation of the American Association of University Professors of which he was the first president. Among his chief philosophical writings are Leibnitz's 'New Essays Concerning Human Understanding' (1888); 'The Influence of Darwin on Philosophy' (1910); 'German Philosophy and German Politics' (1915); 'Studies in Logical Theory,' and, in addition to minor works on ethics which are out of print, a widely used textbook in 'Ethics' (1908), written in conjunction with Professor Tufts of the University of Chicago. Since the death of William James, he is regarded as one of the leaders of the pragmatic movement in philosophy. His writings in education include books on 'The Philosophy of Education'; 'How We Think'; 'Schools of To-morrow'; 'Interest and Effort' (1913); 'Moral Principles in Education'; 'Child and Curriculum'; 'School and Society,' the last-named work having been translated into most European languages as well as Japanese.

DEWEY, Lyster Hoxie, American botanist: b. Cambridge, Mich., 14 March 1865.

He was graduated from Michigan Agricultural College in 1888, and taught botany there 1888–90. He was assistant botanist of the United States Department of Agriculture 1890–1902, and after 1902 botanist in charge of fibre investigation. He has conducted investigations on grasses and troublesome weeds, was United States representative to the International Fibre Congress at Soerabaia, Java, in 1911. He is the author of several bulletins of the Department of Agriculture on the production of fibre from flax, hemp, sisal and manila plants, on the classification and origin of the varieties of cotton, etc.

DEWEY, Melvil, American educator and librarian: b. Adams Centre, N. Y., 10 Dec. 1851. He was graduated from Amherst College in 1874; was college librarian during his senior year and for two years after graduation. He then went to Boston where he was active in founding the American Library Association, the Library Bureaus, the Metric Bureau for introducing the metric system, and the Spelling Reform Association. He was the founder and for five years the editor of the *Library Journal* and also editor of *Library Notes* and the *Spelling Reform Bulletin.* In 1883 he was appointed librarian at Columbia, and in 1887 established the School of Library Economy, of which he was made director. In 1889 he became secretary of the University of the State of New York, and director of the State Library, the library school being at that time transferred to Albany; in 1891 he became director of the home education department, and organized the system of traveling libraries. In 1895 he promoted and organized the Lake Placid Club, a co-operative country residence club with an estate of 6,000 acres, 4 clubhouses, 60 cottages, dairy and poultry farms and forests in Essex County, N. Y., worth over $1,100,000. He is at present devoting his time to general library and allied educational interests, and the business centering round the Lake Placid Club, of which he is president and treasurer. In New York State he has accomplished much in the raising of school standards, and particularly in the improvement and founding of small public libraries. He has also had much influence on library work in the United States; has twice been president of the American Library Association, and its secretary for 15 years; he devised the decimal system for the classification of books which is widely used, and published a set of cataloguing rules, included in his 'Library School Rules.' He has also published a revision of the laws of New York State in regard to education (1892), and the 'Decimal Classification and Relativ Index' (9 editions 1876–1915).

DEWEY, Richard (Smith), American alienist: b. Forestville, N. Y., 6 Dec. 1845. He was graduated at the University of Michigan in 1869. During the Franco-Prussian War he was volunteer assistant surgeon at the field hospital at Pont à Mousson, France, and at the Reserve Hospital at Hesse-Cassel, Germany. He studied for a short time under Virchow at Berlin and from 1872 to 1879 was assistant physician at the State Hospital for the Insane at Elgin, Ill. From 1879 to 1893 he was medical superintendent of the State Hospital for the Insane at Kankakee, Ill., and from 1893 to 1909 was professor of mental and nervous diseases at the Chicago Postgraduate Medical School. He is a writer on mental diseases and in 1899 was president of the Chicago Neurological Society.

DEWEYLITE, a hydrated silicate of magnesia, ranging in color through all shades of white, yellow, red and brown. It was named after Chester Dewey, an American naturalist.

DEWI, Saint. See DAVID, SAINT.

De WINDT, dę wint, **Harry,** English traveler: b. Paris, France, April 1856. He was educated at Cambridge, and, after serving as aide-de-camp to his brother-in-law, Rajah Brooke at Sarawak, 1876–78, went from Pekin to Paris by land 1887; visited mines and prisons in Siberia 1890–94; explored the Klondike 1887, and went from Paris to New York by land for the London *Daily Express* 1901–02. He has written 'On the Equator' (1882); 'From Pekin to Calais by Land' (1887); 'A Ride to India' (1890); 'Siberia as it Is' (1892); 'The New Siberia' (1895); 'Through the Gold Fields of Alaska to Bering Strait' (1898); 'True Tales of Travel and Adventure' (1899); 'Finland as it Is' (1901); 'From Paris to New York by Land' (1903); 'Through Savage Europe' (1903); 'My Restless Life' (1908).

DEWING, Thomas Wilmer, American figure and portrait painter: b. Boston, 4 May 1851. He was a pupil of Boulanger and Lefèbvre and is an academician of the National Academy of Design 1888, and a member of the Society of American Artists. Among his pictures are 'Prelude'; 'The Days,' which took the Clarke prize in 1887, and 'The Garden.' He is represented in the Metropolitan Museum of New York; the Corcoran Gallery, Washington; the National Gallery, Washington; the Saint Louis Art Museum; the Buffalo Academy of Art; the Toledo Museum; and the Rhode Island Gallery of Art, Providence.

DE WINT, Peter, English landscape painter in water-colors: b. Stone, in Staffordshire, 21 Jan. 1784; d. London, 30 June 1849. He studied in the schools of the Royal Academy, where he occasionally exhibited; but most of his pictures were shown in the exhibitions of the Water-color Society. English scenery was his favorite subject. He occasionally painted in oil with marked success. Some of his best pictures are 'A Corn-field'; 'Woody Landscape with Water'; 'Lincoln Cathedral'; and 'Harvest-time.'

DE WINTER, dę vin'tėr, **Jan Willem,** Dutch admiral: b. Kampen 1750; d. 1812. He entered the navy at the age of 12 and fought in the French ranks under Dumouriez and Pichegru, reaching the grade of brigadier-general. He returned to Holland in 1795 and was made commander of the Dutch fleet, composed of 15 ships of the line and 12 frigates. On 11 Oct. 1797 he was attacked by Admiral Duncan's British fleet and defeated at Camperdown, losing his own and seven other ships to the enemy. He was taken to England a prisoner of war, was treated there with distinction and on his return to Holland was even commended for his gallantry and skill in the disastrous fight. He was made Minister Plenipotentiary to France in 1798 and in 1802 was again at the head of the Dutch

fleet. He attempted to suppress piracy in the Mediterranean. He was buried in the Pantheon, his heart in the Nicholas Church of Kampen.

DE WITT, dẹ vĭt, **Cornelius**, Dutch naval officer: b. Dort 1623; d. 1672. He was educated at Leyden. In 1652, with de Ruyter, he succeeded Tromp in command of the fleet which Blake defeated off Kentish Knock. He was with de Ruyter at the burning of British shipping in the Medway in 1667 and took a prominent part in the battle of Solebay (Southwold). Tichelaar accused him of participation in the plot to murder the Prince of Orange and he was tortured and sentenced to banishment. When he was leaving the prison the burghers of The Hague attacked and murdered him and his brother, Jan De Witt.

DE WITT, Jan, Dutch statesman: b. Dort, 24 Sept. 1625; d. The Hague, 20 Aug. 1672. His father was Jacob De Witt, a prominent figure in the stormy dissensions of Holland's political life, and an ardent supporter of the Republic against the hereditary stadtholders of the house of Orange. The boy received a thorough education, and because of his natural precocity absorbed his father's political views at an early age. In 1652, he was sent in the capacity of deputy to the state of Zealand, in order to secure the allegiance of that province, which seemed to have monarchical leanings. So convincing were his efforts, that on his return he was made grand pensionary of Dort (1653), holding that office by repeated election until 1672. De Witt soon demonstrated that the confidence which the Republic had given him was not misplaced. He first turned his attention to the administration of foreign affairs, and succeeded in establishing amicable relations with England. In his negotiations with Cromwell, he took special pains to exclude the possibility of playing into the hands of the rival party of the young Prince of Orange. A secret clause inserted in the treaty rendered the office of stadtholder impotent. In his relations with Sweden and Portugal, De Witt was equally fortunate. He did not neglect the internal administration during this time, but set about fixing its finances on a firm basis, and developed the East Indian commerce. But trouble lay ahead. Charles II was restored to the English throne, and the secret clause inserted in the treaty by De Witt and Cromwell was wiped out. Hostilities were resumed on the sea. De Witt bent all his splendid energies to the task of defending the honor of his state, and finally, with the aid of the naval prowess of Admiral de Ruyter, brought the war to an end with the Treaty of Breda (1667). He further secured his position by the brilliant triple alliance of the Dutch Republic with England and Sweden. However, this produced only a lull in the gathering storm. It had been easy enough to suppress the adherents of William III during his minority. But as time elapsed, they grew to formidable numbers and power. They awaited an opportune time to restore the stadtholder, and the psychological moment finally came. Louis XIV in 1672 suddenly appeared at the head of an army to claim the Spanish Netherlands in the name of his wife, Maria Theresa. The Republic turned to William to resist the invasion; and foreseeing open hostility, De Witt resigned from the office of grand pensioner in August. Events followed rapidly. Cornelius, the brother of De Witt, was arrested on charge of conspiracy against William and sentenced to banishment. Jan came to visit him on the day of his release; and, while returning from the prison, both were attacked and killed by the infuriated burghers. When years had mellowed the passions of the moment, Holland saw De Witt in his true light; and in recognition of his splendid services and sterling qualities erected a monument, the work of Jeltsema, at The Hague, June 1918. Among his writings are his 'Memoirs' (1709) and his 'Letters' (6 vols., 1723–25). Consult Beck, 'History of the Netherlands' (New York 1898–1907); Geddes, J., 'The Administration of John De Witt' (London 1879); Knottenbelt, 'Life of Jan De Witt' (1862); Motley, 'History of the United Netherlands' (4 vols., New York 1860–62); Pontalis, 'Jan de Witt' (Eng. trans., 2 vols., London 1885); Simons, 'Life of Jan De Witt' (1832–36).

DEWITT, Benjamin, American physician and educator: b. Ulster County, N. Y., 26 Dec. 1775; d. New York, 10 Sept. 1819, son of Andries De Witt, M.D. He was graduated at the University of Pennsylvania in 1797, practised and lectured at Albany and New York, occupying the chair of the practice and institutes of medicine in Columbia College and became vice-president of the College of Physicians and Surgeons. For the latter he secured from the State legislature a grant of $30,000. Dr. Thomas W. Blatchford, as orator at the 54th commencement of the medical department of Columbia College, recalled him in these words: "He was a fine looking gentleman, of a tall, portly, commanding figure, open countenance, affable manners, pleasing address and delivery, a popular lecturer and a great favorite with the students." His death was due to yellow fever contracted while engaged in the duties of health officer of the port of New York.

DEWITT, Moses, American surveyor and pioneer: b. Ulster County, N. Y., 15 Oct. 1766; d. Onondaga County, N. Y., 15 Aug. 1794. He assisted in running the Pennsylvania boundary and in laying out the Military Tract of central New York; was appointed county judge and surrogate for Herkimer County on its erection in 1791 and for Onondaga County on its separation in 1794. He engaged in the salt industry at Syracuse and with his brothers Egbert and Jacob Rutzen settled near Jamesville. His active and useful career was ended most untimely by bilious fever. That his memory was long cherished was shown in 1835, when the town of De Witt was set off near his estate and named in his honor.

DEWITT, Richard Varick, American capitalist: b. Albany, N. Y., 6 Feb. 1800; d. there, 7 Feb. 1868. Graduating from Union College in 1817, he was admitted to the bar and developed an artistic and literary taste and a scientific interest that made him a serviceable member of the Albany Institute during its period of scientific activity and repute. He was active also in several large business concerns and shared in the promotion of the Cayuga Lake Steamboat Company and the Ithaca and Owego Railroad Company, which latter were embarrassed by the panic of 1837. Served as brigadier-general of the Albany County militia, 1823–28, and succeeded his father in the Society of the Cincinnati, of

which he was vice-president for New York, 1848–68.

DEWITT, SIMEON, American patriot and statesman: b. Wawarsing, Ulster County, N. Y., 26 Dec. 1756; d. Ithaca, N. Y., 3 Dec. 1834. His father was a physician and descendant from a pioneer settler of Esopus, Tjerck Claessen DeWitt, who probably came from East Friesland. Studied under Domine Dirck Romeyn and was at Queens (now Rutgers) College, New Brunswick, N. J., when Washington retreated before the British in the autumn of 1776. Returning home, he continued the study and practice of the surveyor's art under the experienced direction of his relatives, the Clintons, and early in 1777 enlisted as adjutant in the State militia and was drafted in the campaign against Burgoyne. Early in 1778 became assistant to Col. Robert Erskine, topographical engineer to Washington, and succeeded him in 1780. His duties were to chart the territory covered by his chief's forces and to lay out lines of defense, in which capacities he shared the Yorktown campaign. At the close of the war the topographical materials of his office, 200 manuscripts, were deposited with the New York Historical Society. In May, 1784, DeWitt was called to succeed Gen. Philip Schuyler as surveyor-general of the State and, though tendered a similar position in the Federal service by Washington in 1796, he continued in the service of his native State for 50 years, supervising in field and office such major enterprises as the establishment of the State boundary lines, the laying out of the extensive public lands and of the city of New York above the older portion, and the laying out and construction of the Erie, Champlain and smaller canals of the State,—in all of which he was the trusted adviser of both Gov. George Clinton and Gov. DeWitt Clinton. In laying out the State lands DeWitt used with good results the system of square townships based on lines of latitude, which had come into use in scattered instances by the time of the Revolution and was later applied extensively by the Federal government in the western domain. Credit long enjoyed by DeWitt for the classical township names of central New York probably belongs to Robert Harpur (q.v.). In 1802 he brought out the first State map based on surveys. In 1804–09 he served as one of the commission to build the first capitol at Albany. His scientific interest and ability were recognized in 1790 by election to the American Philosophical Society. In 1798 he was made a member of the Board of Regents of the State University and served as vice-chancellor and chancellor. He was active in the organization of several societies for the encouragement of agriculture and the useful arts. These societies were in 1824 merged into the Albany Institute, which for many years had a wide repute for its scientific researches and learned publications. DeWitt acquired a large tract of land at the head of Cayuga Lake and by his liberality fostered a settlement which has grown to the city of Ithaca. Publications: 'The Elements of Perspective'; 'Considerations on the Establishment of an Agricultural College' (a remarkable plea to the New York legislature in 1818), and a number of scientific essays.

DE WOLFE, Elsie, American actress: b. New York 1865. She made her début in Sardou's 'Thermidor' in 1890, playing the rôle of Fabienne with Forbes-Robertson. She joined the Empire Stock Company in 1894 under Charles Frohman and later became the star and manager of her own company, bringing out 'The Way of the World' in 1901 at the Victoria Theatre. She toured the United States with this play and later appeared in the title rôle of Hubert Davies's 'Cynthia' (1903), as Estelle Kitteridge in 'The Other Girl' (1903) and as Mrs. Lovette in 'A Wife Without a Smile' (1904). She retired from the stage in 1905 and has since engaged in house decorating. She has decorated the Colony Club, New York, the homes of J. Ogden Armour, Chicago and William Crocker, Burlingame, Cal., and many others. She published 'The House in Good Taste' (1913).

DEWSBURY, England, a municipal and parliamentary borough in the West Riding of Yorkshire, nine miles south of Leeds. Coal is mined, but the trade of the town is chiefly in heavy woolen cloths, including blankets, carpets, flannels and worsteds. It has manufactories for fancy cloths and shoddy goods and contains iron and boiler, glass and dye works. Pop. of municipal borough 53,351; of parliamentary borough (one member) 76,923.

DE WULF, Maurice Marie Charles Joseph, Belgian educator and philosopher: b. Poperinghe, 6 April 1867. He was educated at Louvain University and after 1893 served as professor of the history of mediæval philosophy there. In 1911 he was one of the honorary presidents of the International Congress of Philosophy. He is a member of the Royal Academy of Belgium and of the administrative council of the Royal Library of Belgium. His numerous publications include 'Histoire de la Philosophie dans les Pays-Bas et al Principauté de Liège' (1895); 'Études historiques sur-l'Esthetique de S. Thomas' (1896); 'Histoire de la Philosophie médiévale' (4th ed., 1913; Eng. trans., by Coffey, 'History of Mediæval Philosophy' 1909); 'Introduction à la Philosophie neo-scholastique' (1904; Eng. trans. by Coffey, 'Scholasticism Old and New,' 1907) and contributions to periodicals and encyclopedias.

DEWWORM, British name for the earthworm (q.v.).

DEXIPPUS, Greek philosopher: flourished in the middle of the 4th century A.D. He was a follower of the Neoplatonist Iamblichus, wrote commentaries on Plato and Aristotle. One of these in defense of the Aristotelian categories appeared in both Greek and Latin texts. The Latin text, with the title 'Quæstionum in Categorias Libri Tres,' was edited by Félicien (Paris 1549) and the Greek text by Spengel (Munich 1859).

DEXTER, Edwin Grant, American educator: b. Calais, Me., 1868. He was graduated at Brown University in 1891, taught there for one year, and in 1892–99 was science master of Colorado Springs High School, director of the Summer School of Science, Colorado Springs, also professor of psychology in the State Normal School at Greeley, Colo. In 1899 he took the degree of D.Ph. at Columbia University and the higher diploma at Teachers College. From 1899 to 1907 he was connected with the University of Illinois successively as professor of pedagogy and psychology, director

of the summer term, director of the School of Education, and dean. In 1907 he became Commissioner of Education in Porto Rico and chancellor of the University of Porto Rico. He served as associate editor of the *Internationales Archivar für Schulhygiene* and of the *Jahrschrift für Körperliche Erziehung.* He has published 'History of Education in the United States' (1904); 'Weather Influences' (1904) and about 50 articles in educational and scientific journals.

DEXTER, Henry Martyn, American Congregational clergyman: b. Plympton, Mass., 13 Nov. 1821; d. New Bedford, Mass., 13 Nov. 1890. He was graduated at Yale 1840, and at Andover Theological Seminary 1844. He filled a pulpit in Manchester, N. H., 1844–49, and was pastor of Berkeley Street Church, Boston 1849–67. He was one of the editors of the *Congregational Quarterly* from 1859 to 1865, becoming editor-in-chief of the *Congregationalist* 1867. He was a staunch defender of the Congregational polity and delighted in controversy. His principal works are 'The Voice of the Bible and the Verdict of Reason' (1858); 'Congregationalism: What it Is, Whence it Is, How it Works, Why it is Better than Any Other Form of Church Government, and its Consequent Demands' (1865); 'Roger Williams and His Banishment From the Massachusetts Colony' (1876); 'The Congregationalism of the Last Three Hundred Years' (1881); 'Common Sense as to Woman Suffrage' (1885); 'Early English Exiles in Amsterdam' (1890).

DEXTER, Henry Morton, American clergyman, editor and historian: b. Manchester, N. H., 1846; d. 1910. He was the son of Henry Martyn Dexter (q.v.); was graduated at Yale University in 1867 and at Andover Theological Seminary in 1870. He spent the next three years in travel, was ordained to the Congregational ministry, and in 1873–78 was pastor of the Union Church at Taunton, Mass. From 1878 to 1891 he edited the *Congregationalist.* He made several visits to England and Holland, and in those countries took occasion to investigate the history of the Pilgrims and early American colonists. He promoted the erection of a memorial tablet to John Robinson at Leyden, Holland, in 1891. He published 'The Story of the Pilgrims' (1899), and 'England and Holland of the Pilgrims' (1905) and numerous magazine articles on historical subjects.

DEXTER, Samuel, American statesman and jurist: b. Boston, 14 May 1761; d. Athens, N. Y., 4 May 1816. He was graduated at Harvard University 1781; was admitted to the bar in 1784. He was repeatedly chosen to the legislature of Massachusetts, and in 1798 was elected senator of the United States. While senator he was appointed Secretary of War in 1800, and in the same year Secretary of the Treasury. He was afterward, at different times, offered foreign missions, but always refused them. About the year 1802 he withdrew from political life, and returned to his profession. He was an unsuccessful candidate for governor in 1814. He was the first president of the first society formed in Massachusetts for the promotion of temperance. Among his publications are 'Letter on Freemasonry' and 'Speeches and Political Papers.'

DEXTER, Timothy, American merchant: b. Malden, Mass., 22 Jan. 1743; d. Newburyport, 22 Oct. 1806. At an early age he became an apprentice at leather dressing, and progressed so rapidly as to soon own his own establishment. He succeeded in amassing a large fortune for those days. He developed certain eccentricities and his peculiar efforts to attain social prominence gave him great notoriety. For example he assumed the title of "Lord" Timothy Dexter, and he constructed odd and bizarre residences in Newburyport, Mass., and Chester, N. H. The grounds of the first house were adorned with 30 or 40 colossal wooden statues of famous men. He included himself in the number adding the inscription, "the greatest man of the East." He gathered together an extensive library of books notable chiefly for their rich and expensive bindings, and also made an extraordinary collection of absolutely worthless paintings, in order to prove his knowledge of art, and supported a poet who was supposed to be ready to sing his praises upon occasions. He wrote a book called 'A Pickle for the Knowing Ones' and also a pamphlet with all the punctuation marks printed upon the last page, there being none in the text proper. While an able and shrewd man of business he was extremely dissipated and was regarded as a victim of a deranged mind.

DEXTER, Me., town in Penobscot County, 40 miles west-northwest of Bangor, on the Sebasticook River, and on the Maine Central Railroad. It contains a public library, several churches, woolen mills, foundries and machine shops and vegetable canneries. The waterworks are the property of the municipality. Pop. 3,530.

DEXTRIN ($C_{12}H_{20}O_{10}$), the commercial name for a group of substances obtained from starch, and very similar to it in composition; also called starch gum, British gum, etc. It resembles gum in being soluble in water, but is distinguished from that substance by composition; by being, like starch, converted into oxalic acid by nitric acid, and not into mucic acid; and especially by causing a ray of polarized light to deviate to the right, a property from which it derives its name. The simplest member of the group of dextrins is malto dextrin, and this is the only one which has been obtained in a state approximating purity. For commercial purposes, dextrin is prepared from starch by heating dry starch to a temperature of from 400° to 480° F., in an iron cylinder revolving over a free flame or in an oil bath — usually rape seed oil. When the starch is first moistened with nitric or hydrochloric acid, the product is whiter but less adhesive as it then contains some sugar. After roasting to the right degree, as indicated by an iodine test, it is quickly cooled to check further conversion. The product is an indefinite mixture of several dextrins with unaltered starch. The transformation may be effected also by the action of dilute sulphuric acid at a temperature a little below that of boiling water. The result in this action is a mixture which contains some dextrin but is mostly dextrose (q.v.). By acting upon starch with diastase (q.v.) dextrin is produced. To water at about 70° or 80° F., in a boiler, 8 or 10 parts of dried malt are added, and then 100 parts of starch after the heat is raised to 140° F. The mixture is kept stirred and the temperature maintained somewhat above

this for 20 minutes, and then, when the thick mass has become quite fluid, it is raised to the boiling-point rapidly, cooled, the clear liquor filtered and evaporated to a syrup. When cold it is an opaque gelatinous mass, which, on drying, becomes hard like gum. It is then crushed, ground and sifted through silk. Dextrin is used in large quantities for thickening calico-printers' colors, as an adhesive for postage stamps, labels and adhesive papers, as a sizing for textiles and for many other purposes. The corn syrup or glucose of the confectioner and the manufacturer of table syrups contains dextrin to the amount of 42 per cent. See GLUCOSE.

DEXTROSE, grape-sugar, starch-sugar or dextroglucose, belongs to the class of Monosaccharides, in the section hexoses. Its formula may be expressed either as $C_6H_{12}O_6$ or $C_6H_7O(OH)_5$. Dextrose occurs along with levulose in very many plants, and notably in grapes and most other fruits; also in honey, and enters into the composition of many animal tissues and particularly in the blood, and also in the urine of diabetic patients. It can be produced by the action of dilute sulphuric acid on cane-sugar, starch, cellulose, etc. It can be best obtained by boiling for several hours 50 parts of starch with dilute sulphuric acid (100 parts of water to 5 parts of H_2SO_4). The solution is then neutralized with chalk, filtered, boiled with animal charcoal to remove traces of color, and then evaporated carefully to dryness, forming an amorphous mass which contains about 60 per cent of dextrose, the remainder being chiefly dextrin. This mass is washed with cold, ethyl alcohol of specific gravity 0.830, and the residue dissolved in more alcohol. Upon cooling the pure dextrose crystallizes out. It may also be crystallized from a concentrated aqueous solution at 90° to 95° F., and it then contains one molecule of water of crystallization, and forms microscopic rhombic crystals, which soften at 60°, melt at 86° and lose their water of crystallization at 110°. Heated to 170° it is converted into glucosan or dextrosan ($C_6H_{10}O_5$), which may again be converted into dextrose by digestion with water or dilute acids. Dextrose tastes much less sweet than ordinary cane-sugar. By the action of sodium amalgam dextrose is converted into mannite, $C_6H_{14}O_6$. A solution of dextrose becomes brown when boiled with caustic alkalis.

Dextrose on oxidation yields in the first instance gluconic acid, $C_5H_6(OH)_5.CO_2H$. Further oxidation results in the formation of saccharic acid, $C_6H_{10}O_8$.

In alkaline solution dextrose reduces completely the oxides of gold, platinum, silver and mercury, the metals being produced. With bismuth, lead, copper, iron, manganese, etc., partial reduction takes place, only the lower oxides being formed. With sodium chloride, iodide and bromide, dextrose forms well-defined crystalline compounds which, however, decompose in aqueous solutions.

Nearly all true yeasts and a great many other organisms, and also zymase, ferment dextrose. In the presence of growing bacteria dextrose yields a variety of products, as lactic acid, butyric acid, cellulose, etc., depending on the species of bacteria present.

DEY, dā (from Turk. day, maternal uncle, a title of dignity), a title formerly given in the 17th century to the Turkish commander of the army in Algiers. The office was attained by seniority. When the French captured Algiers in 1830, the title and office were of course abolished. The title of dey as given to the governor of Tunis has been replaced by that of bey, since the end of the 17th century. There still exists a dey of Tripoli.

DHABB, dăb. See DAB.

DHAK TREE, dăk, or **PALAS,** a species (*Butea frondosa*) of the genus *Dhawk* of the family *Leguminosæ*, native to India. It has trifoliate leaves with a velvety under surface. They yield a resinous exudation. The gum of this species is said to contain about 70 per cent tannin. The bark and roots, being very fibrous, are used for calking boats, rope making, etc., and the flowers yield a beautiful orange dye.

DHAL, dăl. See PIGEON PEA.

DHALAK, dä-läk', or **DAHLAK,** East Africa, an archipelago of the Red Sea, off the coast of Eritrea, belonging to Italy. It contains nearly 100 rocks and islets, mostly uninhabited, clustering round Dhalak-el-Kebir, the principal island, 23 miles long by 15 miles broad, situated 25 miles east of Massonah. Coral and pearls are the chief products.

DHAMAR, da-mär', or **DAMAR,** Arabia, a town of Yemen, 65 miles south of Sana, on the route to Mecca. It is situated in a thriving agricultural district and carries on a large trade in horses. Pop. about 19,000.

DHAMMAPADA, d'hŭm"mă-pŭd'ą, a section of the sacred writings of the Buddhists. It was translated by Max Müller in 'Sacred Books of the East' (Vol. X). The Pali text was published, with a Latin translation by V. Fausböll (Copenhagen 1855). Consult the Pali commentary edited by H. C. Normand (London 1909–12), and for selections consult Anderson, 'Pali Reader' (London 1907).

DHANIS, dă'nēs', **François,** BARON, Belgian explorer: b. London 1859; d. 1909. He went to Africa and took part in extending Belgian interests there. In 1888 he founded several stations on the Middle Kongo and in 1890 explored the Stanley Falls region to the Kwango. He was attacked by Arab slave raiders and in 1892–93 he carried on hostilities against several fortified towns, finally establishing the supremacy of the Kongo Free State. On his return to Belgium he was made a baron and in 1895 returned to the Kongo as vice-governor. In 1896–97 while on an expedition to the Nile the black troops mutinied, Dhanis' brother was slain and he himself escaped with difficulty. His later years were spent in retirement in his native country.

DHAR, dăr, India, (1) a small native state in the Malwa agency, in the central part of India, with an area of about 1,740 square miles. The soil is fertile, and yields rice and other cereals. Pop. 169,474. (2) The capital, of the same name, is situated about 180 miles east of Baroda. An extensive trade in grain is carried on. Some striking buildings still standing are relics of its former importance and greater population. These include mosques, temples and tombs. A fort built of red stone stands outside of the town. Pop. about 15,000.

DHARANGAON, dăr-ăn'gă-ón, India, city in the Khandesh district, Bombay, having a

trade in cotton and oil-seeds, and manufactures of coarse cloth. Pop. 14,172.

DHARMAŚASTRA, d'här'ma-shäs'tra, the metrical law books of Manu, Yajnavalkya and others. The Manu book is translated by Burnell (London 1884), but its date has not been fixed. The Yajnavalkya book dates from the 3d century A.D. For a collection of these texts consult the 'Dharmaśastrasangraha,' edited by Pandit Jibananda Vidyasagara (Calcutta 1876). Consult also Jolly, 'Recht und Sitte,' with bibliography (in Bühler, 'Encyclopædia of Indo-Aryan Research' (Strassburg 1896).

DHARMASUTRA, d'här'ma-soo"tra, a section of the Sutra or liturgical literature of the Vedas. It is devoted to the definition of ethical relationships and on it the Dharmaśastra (q.v.) or law books are based.

DHARWAR, där'wär, India, city, capital of a district of the same name, in the southern Mahratta country, in Bombay presidency. Strongly fortified, it is prominent as a railway centre, being the headquarters of the Southern Mahratta Railway and having extensive trade in cotton with the Portuguese city of Marmagoa. American cotton is raised successfully and silk and cotton goods are manufactured in the district. Pop. 30,300.

DHAUN, down, **Leopold Joseph Maria, Count von,** Austrian military commander: b. Vienna, 24 Sept. 1705; d. there, 5 Feb. 1766. He began his military career in his father's regiment; he repeatedly distinguished himself in the Turkish campaigns of 1737–39 and in the War of the Austrian Succession, rose rapidly in rank, being made a field-marshal and privy councillor after the Peace of Aix-la-Chapelle. On the opening of the new military academy at Wiener-Neustadt, Dhaun was appointed its first director. Under his vigorous régime, the Austrian army underwent considerable reorganization. In 1757, he was placed in chief command of the army, and advanced against Frederick the Great in Bohemia. His first great success was achieved at Kolin (1757), where by a decisive victory over the forces of Frederick, Bohemia was freed from the enemy. However, Dhaun suffered defeat at Leuthen in December of the same year; but, rallying his forces, inflicted a terrific blow on the enemy in the following year at Hochkirch; and again in 1759, captured the entire army of General Fink with 11,000 men at Maxen. He was finally defeated and severely wounded at Torgau (1760); and after three years more of tedious fighting, with no signal defeats or victories, ended his military career with the Peace of Hubertsburg (1763). Dhaun combined skill with valor in the execution of his strategic plans, but was outwitted by the more brilliant tactics of the versatile Frederick. Consult 'Leben und Thaten des Grafen Leopold von Dhaun' (Frankfort and Leipzig 1759–60). See SEVEN YEARS' WAR.

DHAWALAGIRI, da-hwäl"ä-gér'ē, or **DHAULAGIRI,** once supposed to be the highest peak of the Himalayas, has a height of 26,826 feet above the sea. It is in Nepal, in lat. 29° N., and long. 82° 30′ E.

DHOLE, dōl, a local Indian name for the wild dog, native to parts of India. It is called "buansu" in the Himalayas. See *Wild Dogs,* under Dogs.

DHOLERA, dō'lėr-a, India, city in the Ahmedabad district of Bombay presidency, on a stream entering the Gulf of Cambay, an important cotton mart. Pop. 10,088.

DHOLKA, dōl'ka, India, city in the Ahmedabad district of Bombay presidency, probably one of the oldest towns in Gujerat. The weaving of women's robes is the principal industry of the town. Pop. 16,494.

DHOW, dow, an Arab, sea-going vessel, ranging from 150 to 200 tons burden, with one mast, a yard the length of the vessel, and a large lateen or triangular sail. A pendant and threefold purchase form the halliards of the yard. On the weather rail are fastened the lower block of the tackle and the end of the fall, so that the tackle supports the mast as a backstay. Three shrouds on each side complete the gear. The dhow is used for merchandise and was often employed in carrying slaves from the east coast of Africa to Arabia.

DHULIA, doo'lē-ä, India, the chief town of Khandesh district, Bombay presidency, situated on the south bank of the Panjhra River. There is a new and old town combined. It is a cantonment town. Considerable trade is done in cotton and oil-seeds, and weaving of cotton. A railway connects it with Chalisgaon, on the main line of the Great Indian Peninsula Railway. Pop. 24,726.

DHULIP, d'hoo-lēp', or **DHULEEP SINGH,** Indian maharajah, son of Ranjit Singh, ruler of the Sikhs: b. 1838; d. Paris 1893. While still a minor he succeeded to the throne on the death of his brother, Charak Singh. In his minority, Lall Singh, Maharanee, allowed the native army to attack the British in 1845. He waged a prolonged warfare against the British and in 1846, by the Peace of Lahore, was compelled to turn over the administration to them. In 1849 he renounced the throne in consideration of an annuity of $200,000. He received his education in England and became a convert to Christianity. In 1864 he married a German and after her death an Englishwoman. In 1886 he abjured Christianity, made an attempt to re-establish his authority and lost his pension as a result. He spent some time in France and Russia, was at length pardoned by Queen Victoria, and again received his annuity. His death in Paris was due to a stroke of apoplexy.

DHUNCHEE, dŭn'chē (*Sesbania aculeata*), a plant of the Leguminosæ cultivated extensively in India for its fibre. It rises from 6 to 10 feet high, has a sparingly branched stem. It grows rapidly in low, moist soils. The fibre is coarser than hemp, unless cut early. The plant is also grown in China. About 500 pounds of fibre per acre is considered a fair average yield.

DHURRA, door'ra, or **DOURAH,** Indian millet. See SORGHUM.

DHYAL BIRD, dī'al, or **DAYAL,** an Eastern bird of the genus Copsychus. It is common in Ceylon, India and China, and is a common cage bird in those countries. The female is of a brownish tinge, while the male is black and white. It nests in tree hollows and at breeding time is exceedingly pugnacious.

DHYANI BUDDHA, d'hī-ä'ne bood'da, one of the five Buddhas, called Śkshobhya, Vairocana, Ratnasambhava, Amitayu, Amitabha

and Amoghasiddhi, with their female counterparts, the Taras or Saktis. They are produced from meditation alone, are eternal and incorporeal. See BUDDHISM.

DIABASE, a word used by petrographers with varied meanings; but the present usage in this country restricts it to crystalline igneous rocks, of the basalt family, generally occurring as dikes, having as essential constituents plagioclase feldspar, augite and magnetite. Olivene may or may not be present. Diabases differ from the granitoid rocks, to which they have a somewhat similar texture, in that the crystals of feldspar are long and narrow, or lath-shaped, and the dark silicates are arranged in the interstices of the feldspar crystals, giving an ophitic texture. Diabases are of common occurrence in the United States. They form dikes and laccoliths at various places along the Atlantic seaboard from Nova Scotia to Georgia. The so-called traps of the Connecticut Valley and the Palisades of the Hudson are familiar examples. In the Lake Superior country diabases are of frequent occurrence; notably in the Marquette Iron Range and on Keweenaw Point; the latter sometimes carry native copper. The convenient field name greenstone is frequently given to old, more or less altered, diabases. By pressure and shearing stresses, and the intrusion of other igneous rocks, diabases change to hornblende and chlorite schists, showing no trace of original structure. Such rocks are common in the Lake Superior region and elsewhere along the Algonkian and Archæan rocks that characterize the formation of so much of northeastern North America. Diabases are of common occurrence in the Rocky Mountains also, and frequently, over deposits, are found along their contacts with sedimentary rocks, particularly limestones. The typical diabase of the Palisades contains: SiO_2 53.13; Al_2O_3 13.74; Fe_2O_3 1.08; FeO 9.10; CaO 9.47; MgO 8.58; Na_2O 2.30; K_2O 1.03. The specific gravity is 2.96. See BASALT; TRAP.

DIABELLI, dyä-bĕl'lē, **Antonio,** Austrian composer and music publisher: b. Mattsee, near Salzburg, 1781; d. 1858. He studied with Michael Haydn and came to Vienna in 1803, settling there as a teacher of piano. In 1824 he established the publishing house known by his name. This house published most of Schubert's works. Diabelli was very prolific as a composer, making use of all forms. His sonatinas written for educational purposes still hold their place among the best works of instruction for the piano. His other works have long since passed into oblivion.

DIABETES INSIPIDUS, a chronic disorder, characterized by the production of large quantities of colorless urine of low specific gravity and containing no sugar or casts and but little if any albumin. It is a disorder particularly of young people, and is more frequent in males than in females. In the larger number of patients it seems to be of congenital origin. Its exact nature is unknown, although it seems to be related to some disturbance of the vasomotor mechanism in the kidneys. As a rule it is a disease of slow onset, the early symptoms being an increasing thirst and the passage of large quantities of urine. Occasionally there are pains in the thighs; the appetite is usually good; there is much thirst; the perspiration is small in amount, and the skin is apt to be rough and harsh. Sometimes there is loss of weight and knee jerks. Otherwise the patients suffer but very little. It is a disease that is rarely prejudicial to health, having been known to persist for 50 years. The main discomfort is the want of rest from the polyuria. Occasionally it passes away without treatment. Treatment is as a rule unsatisfactory and there is little benefit from dieting. See DIABETES MELLITUS.

DIABETES MELLITUS, a disorder of nutrition, in which there is deficient oxidation of the sugar in the body, which permits of the storing up of large amounts of sugar in the blood. This is eliminated in part in the urine, and there constitutes one of the most positive findings of the condition. In European countries it is from three to five times as common as here, although statistics seem to show that it is on the increase in the United States. The symptoms vary very widely as the disease is often complicated with other nutritional diseases such as albuminurea, tuberculosis and digestive diseases. There is an acute form of the disease which proves rapidly fatal, but in the majority of cases there is a gradual onset, during which increased urination and increased thirst are the initial symptoms. Following this, if the disease progresses, the thirst still increases; there is passing of large quantities of urine containing glucose; very marked increase in the appetite, amounting sometimes almost to voraciousness and gluttony; and an accompanying progressive emaciation or the patient becomes obese. Appetite though usually ravenous may fail. The skin is dry and harsh; temperature is often below normal; the tongue is bright red and glazed; the gums may be swollen; and constipation is the rule though there may be serious diarrhœa.

As the disease progresses there are apt to be boils, abscesses, pimples, eczema, intense itching or cellulitis from slight injuries. Perforating ulcer of the foot may occur, and occasionally there is bronzing of the skin. Acute pneumonia is a frequent cause of death. Gangrene of the lung may also arise. In most cases, particularly in the young, there is a form of progressive intoxication due to the gradual retention in the body of acids which are not properly neutralized by the body's protective agencies. There is gradually progressive anæmia, headache, delirium, great distress and marked hunger for air, which may be accompanied by blueness of the skin or by jaundice. Neuralgic pains are also frequent complications in diabetes. Arterio-sclerosis may be a result. In the young, especially, there is a liability to functional and structural heart diseases.

The cause of diabetes mellitus is a matter of much inquiry, but it would seem that it is a disease of a number of origins. Fundamentally, however, it is due, as implied at the beginning of this article, to some interference with the physiology of sugar-oxidation. This may result from disease of the pancreas, disease of the suprarenal gland, sometimes disease of the central nervous system, and occasionally disorder of the sympathetic system. The pancreas and the suprarenals are considered at the present time as the site of the chief changes leading to the production of this disease. The

outcome is usually dark. In children, as a rule, it progresses rapidly to death. There seems to be an intimate relation between gout and diabetes mellitus, both aggravated by worry, business troubles and mental overwork — hence "Gouty Glycosuria" of the old. Middle-aged people may live for many years, but instances of cure in true diabetes are quite rare. The treatment is largely hygienic, and is extremely complicated. At present time Dr. Allen's so-called "starvation treatment" is uppermost. Diet and hygiene are the most important factors. Each patient having his idiosyncrasies, medical advice on the matter of diet is imperative. The patient, not the disease, needs treatment; hence general rules are more productive of harm than of good.

DIABETIC SUGAR ($C_6H_{12}O_6$), formerly supposed to be a distinct species of sugar, now found to be the same as glucose (q.v.). It is regularly produced by the liver, and is a constant though trifling constituent of healthy urine, but in diabetes mellitus (q.v.) it amounts to 8 or 10 per cent. See INOSITE.

DIABLERETS, dē-ä'blē-rā', **Les** (Fr. "the little devils"), a secondary mountain group of the Bernese Alps, Switzerland, between the canton Vaud and canton Valais. The highest peak is 10,620 feet. Two peaks have already fallen, and others threaten to follow. The rocks consist of limestone, resting at a high angle on beds of shale, which becoming disintegrated leaves the limestone without support, and causes tremendous landslips. The most disastrous took place in 1714 and 1749. By the former the surrounding district was shaken as by an earthquake, and many human beings and cattle perished; by the latter the course of the Liserne was arrested, and two small lakes formed.

DIACAUSTIC (dī-ą-kâs'tĭk) **CURVE,** a curve of intense light, formed by the consecutive intersections of rays refracted through a lens.

DIACHYLON, dī-ăk'ĭ-lŏn, a combination of oxide of lead or litharge, olive oil and water. It is, in fact, lead soap, insoluble in water, and sparingly soluble in alcohol, hard and brittle while cold, but soft on heating. It is used in surgery as the basis of adhesive plasters.

DIACRITICAL MARKS. A mark used to indicate a special value for the letter to which it is attached. Such a mark may be a conventionalised letter as the ° in the Swedish å, originally an *o*, or the ¨ in the German ä, ö, ü, originally an *e*. Similarly the cedilla (¸) under a *c* in French and Portuguese was formerly a *s*, and the Greek iota subscript was written in the classical period on the line like any other iota. The ~ or tilde over *n* in some Spanish words and English words derived from the Spanish was once nothing but another *n*. The accents and long and short signs explain themselves, and are nothing but arbitrary signs. In those Slavic languages which are written in Latin characters, and in other languages of eastern Europe, diacritical marks are enormously multiplied. The Semitic alphabets represent the vowels and the modifications of the consonants by diacritical marks. English uses only the hyphen (-), the cedilla (¸), the tilde (~), the diæresis (¨). The hyphen is not in the strictest sense a diacritical mark; it is used to separate the components of certain compound words. The diæresis is placed over the second of two adjacent vowels which might be mistaken for a diphthong: thus coöperate. The tilde is only found in words from the Spanish, such as *cañon,* and indicates that the *n* over which it stands is palatalised. The accents are used over a final *e* or *ed* to show it forms a syllable, as *peakèd,* Bronté. A cedilla indicates that the *c* over it is pronounced like an *s*.

Diacritical marks are used according to several distinct systems in the various styles of phonetic spelling for scientific purposes. See PHONETICS.

DIADEM, a band for holding together the adjusted hair of the head, a wreath or chaplet for the head or forehead. In Oriental antiquity it was employed as a badge of royalty or nobility among the Egyptians, Assyrians and Babylonians. It was called *nefer* among the ancient Jews, and was worn as an ornament by kings and high priests, when it took the form of a golden circlet for the brows. Among the Persians, Armenians and Parthians, the kingly and queenly diadem was a broad band of pale blue. Alexander the Great adopted this regal decoration after contact with the Persians, and his successors followed his example in this fashion. The Greeks early adorned their greater gods with the diadem, notably Zeus, Hera and Aphrodite, and it later became the universal ornament of their women, and their young men, especially the Olympic victors. These diadems were made of such various materials as metal and leather. Among the Romans Ancus Martius introduced the diadem from the Etruscans, but it was abolished on the expulsion of the kings. Which of the Cæsars revived its use is not known. According to some authorities Aurelian first assumed it. Its use among the non-Roman kings and princes of Europe appears to have been universal. Under Constantine the Great the imperial diadem was studded with gems and took a form which rendered it the prototype of the crowns worn by mediæval and modern monarchs. See CROWNS.

DIADEM SPIDER, a common spider (*Argiope diadema*) so named from its markings, found throughout Europe. See SPIDER.

DIADUMENOS (Greek, binding around), famous statue by Polyclitus, showing an athlete binding a wreath about his head.

DIÆRESIS, dī-ĕr'ę-sĭs, in grammar, the resolution or separation into distinct syllables of two vowels whose juxtaposition has either caused them to coalesce or threatened them with coalition. In printing, a mark (¨) placed over the second of two adjacent vowels to indicate that they should both be pronounced: as, aërated.

DIAGEOTROPISM, a form of sensitiveness to gravity, in which the bending part grows at right angles to the direction of gravity. See GEOTROPISM.

DIAGNOSIS (Gr. from *dia,* through, and *gnōsis,* knowledge), *in medicine,* the discrimination of diseases. It includes the study of all the vital phenomena of diseases, and also of their appearances after death, in so far as this can aid their discovery during the life of a patient. It is usual to speak of rational or physiological diagnosis, or diagnosis by symptoms, that is, changes chiefly functional, ob-

served by the patient; and of physical diagnosis, or diagnosis by signs, that is, objective phenomena appreciable by the senses of the observer by means of tests of the throat, chest, abdomen, blood, eyes, urine, stool, heart, etc., with various instruments. The latter method of diagnosis has been much enlarged in scope and increased in importance by the modern methods in medicine of auscultation and percussion and also by the great advances made in physiological chemistry, and by the use of the microscope. Skill in diagnosis is one of the highest gifts of the physician.

DIAGONAL, DIAGONAL LINE, a straight line joining two angles not adjacent, in a rectilinear figure. Every rectilinear figure of more than three sides may be divided by diagonals that do not intersect, into as many triangles as it has sides, minus two. To find the number of possible diagonals, take three from the number of the sides, multiply the remainder by the number of the sides and halve the product.

DIAGONAL SCALE. A device for graphically constructing fractional parts of a line, such as hundredths. A square is laid off with sides of unit length. This is then subdivided by equally spaced parallel horizontal lines dividing each side into 10 parts. The top and bottom are also divided into 10 parts, and oblique lines are drawn from the upper left hand corner to the first subdivision of the bottom, from the first subdivision of the top to the second subdivision of the bottom, etc. The length of the *m*th horizontal line from the left side of the square to the place where it crosses the *n*th oblique line will then be $\frac{n}{10} + \frac{m}{100}$: thus the length of the 3d horizontal line to the place where it crosses the 5th vertical line will be .53. Diagonal scales are used in mechanical drawing and especially in plotting maps. The desired distance is laid off on the scale and transferred to the map with a pair of compasses.

DIAGORAS, dī-ăg'ō-rąs', **OF MELOS,** Greek philosopher: b. Corinth about 412 B.C. He was a pupil of Democritus of Abdera. On account of his ridiculing the popular religion, he was charged with impiety, and received the surname of the Atheist. Fearing for his life, he fled from Athens and went to Pallene and finally to Corinth. He was the author of lyrics and two treatises, one against the gods and the other attacking the sacred mysteries.

DIAGRAM, a figure or geometrical delineation applied to the illustration or solution of geometrical problems, or a description or sketch in general. A diagram is characterized by the subordination, conventionalization, or omission, of unessential features, leaving the emphasis to fall on the important points of the object to be represented. Anciently, it signified a musical scale. Among the Gnostics the name diagram was given to a figure formed by the superposition of one triangle on another, and inscribed with some mystical name of the Deity, and worn as an amulet.

DIAKOVA, dē-ą-kō'va, Montenegro, town in the extreme southeastern part of the country, 20 miles northwest of Prisrend, on a tributary of the White Drin. For many centuries it was held by the Turks, being one of the most important towns in the Kosovo vilayet. In the Balkan War of 1912–13 it was occupied by Serbia, and, in the subsequent rearrangement of territory and by agreement between Montenegro and Serbia, it was given to the former. The inhabitants, numbering about 15,000, are in great part Mohammedan and Roman Catholic Albanians.

DIAL, Sun. See SUN-DIAL.

DIALECT, from the Greek *dialectos,* Latin *dialectus,* Ancient French *dialecte,* a conversation, discourse, manner of speaking, language of a district or country; derived from the Greek verb *dialegesthai,* to speak through, or across. Hence the term *dialect,* strictly applied, signifies speech or vehicle of conversation, phraseology, idiom, apart — though not necessarily — from what is written. A dialect that is indigenous or native to a particular place is called a *vernacular.* A striking example of the latter exists in the so-called Pennsylvania-German dialect, a mixture of Frankish and Alemannic, which in recent years has blossomed into a literature. In relation to modern languages, dialect usually means a variety or form of speech differing from the standard or literary "language"; a local variation. The French call this *patois;* their scholars distinguish *dialects* as variations of a language which is not a common or written language. In its widest sense the name dialect is applied to branch languages springing from a common root, as the Romance tongues, French, Italian, Spanish, Portuguese and Rumanian, originated from a common Latin root. Dialects are not in all cases mutilated or corrupted forms of their standard language, for not only does every great language owe its origin to dialects, but is merely a promoted or elevated dialect itself. The English language arose from the Old Saxon, Old Frankish and Old Frisian dialects, with a large admixture of Latin, Norman-French and the standard or literary French of Paris. But it was not till Chaucer's time, the latter half of the 14th century, that the East Midland dialect of Britain — geographically located between the Northern and Southern dialects — became the English literary language. There were then six great forms of local speech, divided into smaller groups. What decided the superiority — if there was any — of the East Midland dialect, was the threefold recommendation that it was the court language, the language of Wyclif's translation of the Bible, and the language in which Chaucer wrote. Despite his modern detractors, the influence of Chaucer, "the father of English literature," was the predominant factor not in making, but in starting, the English language. Yet no one who knows that language as it is to-day could, without special study, read Chaucer's dialect and understand it. Philologists assure us that even Shakespeare's English, if spoken, would be quite unintelligible to our ears. Great languages need centuries to grow; their scientific grammatical frame-work and vast vocabularies represent the contributions of untold thinkers and writers. Dialects, on the other hand, are not consciously created; their primitive origins are veiled in obscurity or, like the beginnings of human speech, entirely unknown. They grow and develop naturally like trees. But a tongue that is merely spoken or not ex-

tensively written cannot well become fixed: for that a literature is necessary. Chaucer wrote in his own dialect and laid the foundation of a literature; that dialect became the literary language. There were four distinct dialects in ancient Greece — the Ionic, Attic, Doric and Æolic, each of which possessed a literature; but the greater refinement and the cultivation of arts and sciences in Athens, where Attic was spoken, finally gave that dialect the superiority; it became the Greek language. Thucydides wrote in Attic, while Herodotus wrote in Ionic, yet none will assert that the "dialect" of Herodotus was a corruption of that of Thucydides. The modern Greek, or Romaic, is derived from the Attic form, and is rather a dialect than a language, notwithstanding that it is the most important tongue in the Levant. The Tuscan dialect became the language of Italy through the genius of Dante, whose mother-tongue it was, as also of his great successor, Petrarch. Italian has many dialects, and even to this day the Italians have not decided which is the correct form of the second person plural. More than half of the people use *voi*, and the rest, *lei*. The accident that Luther spoke the High German dialect and translated the Bible into it made that dialect the standard German language, though here again, as in English, enormous changes have taken place through the adoption of foreign words. The Low German or Plattdeutsch (Pladdütsch) bears a strong resemblance to English, while some of the Southern German dialects are almost incomprehensible to the High German. Just as London has its "cockney" dialect, so both Berlin and Vienna have special German dialects, easily recognizable. In the Slavonic family of languages numerous dialects are also encountered. The Great Russian is remarkably free from dialects; Ukrainian or Little Russian may almost be regarded as a distinct language with a literature of its own. But fully 80,000,000 people understand the literary Russian language — the "Moscow dialect." Few living languages have so many dialects as the Arabic. Not infrequently one finds several different dialects spoken in the various districts of the same city. The literary Arabic is inviolably fixed by the Koran, but the "vulgar" Arabic of Egypt differs from that of the Sudan, while greater dialect groups exist in Syria, Tunis, Algiers and Morocco. Dialects of Turkish (one of the most scientifically constructed languages) are spoken throughout central Asia to China, and also as far north as the White Sea. Maltese is a mixed dialect of Italian and Arabic. The Jewish dialects of Europe, though based upon biblical Hebrew and the neo-Hebraic idiom of the Talmud and Mishna, incorporate many French, German, Spanish, Russian or Polish words, according to the country in which they are spoken. The so-called "Yiddish" is largely German, and is understood throughout Russia, Austria-Hungary and the Balkans. Chinese may be divided into two branches — the written language and the spoken language. The former is understood by all who can write, but the latter is so violently split up into dialects that sometimes Chinese of different provinces can only verbally communicate with each other through the medium of "pidgin" English. In the Philippines some 30 distinct languages, divided into almost innumerable dialects, are spoken both by the Malayan and Negrito tribes. The great languages of India present a bewildering mass of dialects. It is estimated that the Iramic and Indic groups of the Aryan family of languages have some 135 dialects; the Dravidian, about 30; the Tibeto-Burman, 84; the island of Sumatra, 14; Celebes, 5; Madagascar, 9; in Australasia, according to one British authority, there are 112 aboriginal languages and dialects. In Africa, Abyssinia possesses two dialects — the Tigré and Amharic, derived from the Ethiopic; the Bantu languages, Haussa, Suaheli and Yoruba, in fact, every native tongue, is split up into dialects or tribal vernaculars. Not a few, indeed, are unknown to white men.

From the above outlines it may be gathered that dialects are a most important factor in human speech. It is difficult, in fact, to draw a sharp line of demarcation between language and dialect. French, Italian and Spanish were Latin dialects; the Scandinavian languages, as well as Dutch and Flemish, began their careers as Teutonic dialects; Portuguese and Spanish were cognate dialects which might have become one language if the two nations had not been separated politically. As regards the English literary language, it would be more correct to call that a dialect than some of the "provincial" variations, for it is constantly changing, both in spelling and pronunciation, whereas the "dialects" in remote places preserve their forms with but little divergence from those of their Saxon or Celtic ancestors. One who has traveled much in the British Isles or the United States can quickly distinguish a speaker's county or state. It may be said that there are but two distinct English dialects, the modern English and the Scottish; on the other hand, few countries, if any, have more variations from the common literary language than the English-speaking nations. The Scottish dialect exists in its purity only in the earlier poets, historians and other writers. In Britain every county has its peculiarities, which are sometimes striking and difficult to be understood, especially in Lancashire, Yorkshire and Devonshire. The French-Canadian dialect is vivid and picturesque. There are several distinct dialects in the United States, as is shown by the dialect literature of the East, the West and the South, and dialect of the slums of New York. Much useful research work has been done by the American Dialect Society. Its valuable publication, *Dialect Notes*, furnishes interesting information on this subject, and *The Ithaca Dialect*, in which a local New York State dialect has been investigated by O. F. Emerson, shows that the differentiations of language in distinct sections will some day furnish abundant material for the student of dialect. British scholars have devoted much attention to the subject. Modern provincial English has been carefully studied, its origin traced and locality recorded in the papers of the English Dialect Society (1873–96). In 1898 the first volume of Wright's great 'Dialect Dictionary' appeared (completed 1905). Consult Axon, W. E. A., 'English Dialects in the 18th Century' (London 1883); Bonaparte, Prince Louis Lucien, 'On the Dialect of Eleven Southern and South-Western Counties, with a new Classification of the English Dialects' (London 1877); also his works on the Basque, French and Italian Dialects; Conway, 'Italic Dialects' (Oxford

1900); Ellis, Dr. A. J., 'English Dialects — Their Homes and Sounds' (London 1890); and 'Existing Phonology of English Dialects' (London 1889); Gröber, 'Grundriss der romanischen Philologie' (Strassburg 1906); Haldeman, 'Pennsylvania Dutch' (1872); Monaci, 'Crestomazia italiana dei Primi Secoli' (Turin 1913); Morris, Dr. R., 'On the Survival of Old English Words in our Dialect' (London 1876); Paul, 'Grundriss der germanischen Philologie' (Strassburg 1900–09); Skeat, W. W., 'Seven Provincial English Glossaries' (London 1874); and 'Ray's Collection of English Words not generally used,' from the edition of 1691 (London 1874); Skeat and Elworthy, 'Specimens of English Dialects' (London 1879); Winkler, J., 'Dialektikor' (Berlin 1874).

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DIALECTIC, the art of separating a subject into its parts by discussion. It thus includes both the use of reason and speech, and is the process of defining an idea or principle and testing the definition by showing all the consequences, both positive and negative, that it involves.

Aristotle is reported to have said that Zeno the Eleatic was the father of dialectic. The justification of this remark is found in the fact that Zeno defends the position of his school by showing through a process of reasoning the absurd and contradictory results that follow from the conceptions defended by their opponents. With Socrates dialectic is an art of investigating a subject by means of conversation carried on by two or more persons, each of whom contributes something to the result, proposing definitions, or calling attention to certain aspects of the subject, or certain negative cases that had been overlooked. Thus Xenophon ('Memorabilia,' Chap. v.) tells us that Socrates said that dialectic was so called because it is an inquiry pursued by persons who take counsel together, separating the subjects considered according to their kinds. Plato extends the use of the term and makes it the art of working up by a methodological procedure of thought to a knowledge of the highest principles of things. As he says ('Republic,' bk. v.), it is the method by which "reason avails itself of hypotheses, not as first principles, but as general hypotheses, that is, as stepping-stones and helps whereby it may force its way up to something not hypothetical and arrive at the first principles of all things and seize it in its grasp." For Plato then dialectic is the term used to describe all logical thinking. Aristotle, however, does not use the term to cover his art of logical demonstration from necessary principles, but ascribes to it a lower place, describing it as the method of dealing with what is merely probable, or of arriving at what is most likely to be true in cases when certain demonstration is impossible.

The term dialectic has also frequently been used in ancient and modern times to denote an empty or sophistical art of playing with words or operating with concepts that have no real meaning or content. Thus Kant in the 'Critique of Pure Reason' employs the word in this sense to denote "the false pretense of knowledge that is based on illegitimate concepts that have no real basis in experience." He names the third main division of his work 'Transcendental Dialectic,' and devotes it to a systematic exposure of the emptiness and futility of this form of reasoning. Hegel, on the other hand, uses the term to describe the true method of the development of thought. According to him there is in thought an internal principle of development in virtue of which it moves through three stages — from a thesis or positive position to the antithesis or negative view that is contradictory of the starting-point, then finally to the synthesis or reconciliation of the two opposing views. Hegel develops this into a universal method of procedure, regarding it as a process that exhibits both the development of the thought-process and also nature of reality, and pointing out illustrations of its course in history and in many departments of life and thought.

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DIALLAGE, dī'ăl-lāj, a laminated variety of pyroxene of a green or brown color and of pearly lustre. It resembles diopside in composition and is also closely akin to augite. The word is also used to designate bronzite and enstatite.

DIALOGUE, a conversation or conference between two or more persons. The dialogues of Plato are a sort of philosophical drama. The Socratic dialogue consists of questions and answers, and the person questioned is obliged, by successively assenting to the interrogatories put to him, to come to the conclusions which the questioner wishes to produce. The Socratic method has been adopted in modern times as a means of instruction in certain schools. Lucian claimed to be the inventor of humorous dialogue (see DIALOGUES OF THE DEAD). Erasmus of Rotterdam, and subsequently, among the Germans, Lessing, Moses, Mendelssohn, Engel, Herder, Jacobi, Solger, have written in this form. In comic and satiric dialogue Wieland has imitated Lucian. Among the most distinguished Italian writers of dialogue are Petrarch ('De vera sapientia'), Machiavelli, Gelli, Algarotti and Gozzi; and among the French, Sarrasin, Malebranche, Fénelon and Fontenelle. Among the English, Bishop Berkeley and Hurd have imitated Plato and Harris, Cicero. Lord Lyttelton's 'Dialogues of the Dead' (q.v.) and Addison's 'Dialogues on Medals,' are well known, but Landor's 'Imaginary Conversations' is the finest production in English belonging to this class of works. In the drama, the dialogue, in a narrower sense, is opposed to monologue or soliloquy; in the opera, it is that which is spoken, in opposition to that which is sung.

DIALOGUES OF THE DEAD. Lucian is a remarkable figure in the world's literature. A native of Syria and living in the 2d century A.D., he wrote the best Greek that had been written in 300 years, and was, indeed, "the last great master of Attic eloquence and Attic wit." At the same time he is distinctively modern in flavor, and with his wide knowledge and experience of the world, his shrewd and penetrating observation, fertile imagination, skilful delineation of character, dramatic power, rare wit and gift of satire, would have been as much at home in the 20th century as in the 2d. He bor-

rowed the dialogue from Plato but breathed into its severe and dignified form the mocking spirit of Aristophanes, to whom indeed he is close akin in spirit. The 'Dialogues of the Dead' are probably the best known, though not the best, of his works. The conversations of Odysseus with the various shades in Hades (Homer's 'Odyssey' XI) doubtless suggested the idea, but all else was original with Lucian; so that he may very properly be called the inventor of this style of composition, in which he has found many modern imitators, for example, Lord Lyttelton, Fontenelle and Fénelon, in their works of the same title, and Walter Savage Landor in his 'Imaginary Conversations.' Consult Rentsch, 'Das Totengespräch in der Litteratur.' The Dialogues are satires upon human life and society, the vanity of human hopes and pursuits; wealth, power, beauty, strength, the disputations of philosophy furnished the materials, and some philosopher like Diogenes or Menippus is usually the commentator. The shortest of the 30 dialogues may give some idea of their quality (VIII).

C. Why, 'tis the proverb fulfilled! The fawn hath taken the lion.

D. What's the matter Cnemon?

C. The matter! I have been fooled, miserably fooled. I have passed over all whom I should have liked to make my heirs, and left my money to the wrong man.

D. How was that?

C. I had been speculating on the death of Hermolaus, the millionaire. He had no children, and my attentions had been well received by him. I thought it would be a good idea to let him know that I had made my will in his favor, on the chance of its exciting his emulation.

D. Yes; and Hermolaus?

C. What his will was, I don't know. I died suddenly—the roof came down about my ears; and now Hermolaus is my heir. The pike has swallowed hook and bait.

D. And your anglership into the bargain. The pit that you digged for other . . .

C. That's about the truth of the matter, confound it.

CHARLES FORSTER SMITH.

DIALOGUES OF LEOPARDI, The. Leopardi's philosophical paragraphs, known to Italians as the 'Operette morali' are mostly in dialogue form; but they are not, as regards substance, to be taken apart from the other prose works composed by him largely in 1824, published first in 1827, and again with slight additions in 1832; nor apart from his 'Thoughts,' belonging to his later days in Naples, and his 'Notebook' compiled between 1817 and 1832. These works contain the clearest exposition of Leopardi's peculiar attitude toward life that we possess. In them many of the themes made famous by the poems are restated or anticipated in a different æsthetic compound. Here the sarcasm is merciless, violent and impotent, lashing men and nature in a despair that permits itself no delusions. The style shows traces of a certain pedantic classicism not wholly vivified by contact with the living Tuscan speech. Erudite also are the motives from which the humor is made to spring. But the movement is vigorous and the attack relentless. The dialogues are models of compactness, clarity, concision, representing indeed the results of Leopardi's meditations on æsthetic theory and his ideas on prose forms, the development of which can be reconstructed from others of his writings.

Too little read by those who know Leopardi only as a poet, the dialogues are, on the other hand, often overestimated as regards their philosophical value. Leopardi's pessimism is not a coherent system. His repudiation of justice, virtue, glory, patriotism, even of truth and love, is in reality an affirmation of these same objects as human ideals, though they are regarded by him as unattainable by man. What is considered, and what he states, as his "philosophy" amounts, thus, only to a social satire that easily degenerates under his vehement bias into an unreasoning and not rarely ungracious scold. Leopardi borrows the principal phrases and some of the spirit of French mechanistic deism of the 18th century. Suppressing the absentee deity of that school — it was in truth a useless encumbrance in social reform — he has left on his hands a hollow lifeless world in which theoretically not even suicide is worth while and which is not resilient enough for a tennis match between Atlas and Hercules. What becomes meanwhile of the humanitarianism, so productive in political and social consequence, that logically springs from the doctrines of French rationalism? This consequence Leopardi, gritting his teeth, everywhere denies; but denies in words only; for humanitarianism remains the universal trait in his deepest moods, just as it is the teaching, if moral there be, of his dialogues. "Live," says Nature to the Soul, "be great and unhappy."

Greatness Leopardi defines as "living in accord with nature," realizing the sublime "excellence" of which man discerns the potentiality within him. If the first phrase is a platitude of the French philosophasters, the second concept embraces all the traditional formulæ of classic and Christian ethics, abstracting, of course, the mystical virtues of faith. Hence the reactionary, aristocratic toryism of Leopardi's misanthropy, his ridicule of pretended progress, of social reform, of scientific discovery and applied inventiveness. These for him are so many phantoms, so many delusions with which cowardly, mean-souled mortals console themselves because they are afraid to look the miserable unredeemable lot of mankind unflinchingly in the face. In this destructive criticism of life Leopardi, it is apparent, holds no view of which the Catholic idealist of his time would not have approved. His pessimism is the point from which Manzoni starts to construct an edifice of Christian hope, and Foscolo to seek a reason for existence in æsthetic contemplation and artistic creation. Leopardi, on the contrary, spreads devastation around himself and then rages at its melancholy expanse. With folded arms he views from a superior pinnacle the bootless struggle of humanity for a goal (happiness) beyond its reach; and from his solitude he looks forward to a time when men have become extinct, with insects and beasts inheriting the earth, the sun itself grown cold and a dim moon performing purposeless revolutions about a planet that is only a sepulchre.

If we put the dialogues in their true social and political tradition, we see how the republican and socialistic movements based on French nationalism failed to redeem and integrate

modern Italy. With their humanitarian implications never developed to self-consciousness, it was a sorry appeal indeed they had to make to a suffering but aspiring populace. The dialogues of Leopardi are representative of states of mind that contributed only negatively to the "Resurrection" of Italy. The positive forces are reflected with equal clearness in Manzoni's 'Betrothed.'

ARTHUR LIVINGSTON.

DIALOGUES OF PLATO, Jowett's Translation of. The worst and the best of Benjamin Jowett's translation of Plato's Dialogues is expressed in two contemporary epigrams. Ingram Bywater, Fellow of Exeter College, Oxford, and Jowett's successor as Regius professor of Greek, used to say, half in jest, "I do not suppose he ever looked at any text of Plato beyond Parker's little Oxford edition"; and it was the opinion of Sir Richard Jebb, of Cambridge, that "Jowett made Plato an English classic." The master of Balliol was, in fact, notoriously deficient in the so-called science of philology. The first edition of his Plato was replete with manifest errors, and the correctness of the third edition is owing in some measure to his docility in following the strictures of his critics. But even the third (standard) edition is not always a safe guide in details. But Jowett was not writing a crib, nor was his concern much with the niceties of Greek grammar. He was a theologian and a student of statescraft as well as a professor of Greek, and he was interested more in the character and practical career of his pupils than in their scholarship. Plato was to Jowett a depository of the wisdom of the ancient world, which, with the parallel wisdom of Christian theology, formed the basis of sound tradition. In such a spirit the Dialogues were offered to Englishmen, and it is in large measure owing to this spirit that the translation of the Dialogues has the manner of an English classic. More specifically, Jowett's success is attributable to his sensitiveness to the peculiarities of the Platonic style. The characteristic virtue of this style is its power of conducting a philosophical argument in the natural give-and-take of cultivated gentlemen seeking the truth together, or in the no less natural thrust-and-parry of a genuine seeker disputing with sophistical babblers and baiting them with irony and sarcasm. There never has been any other language, not even Greek in the hands of any other writer, so finely adapted as Plato's at its best for just this sort of conversation, shifting as it does with incomparable ease from light to grave and from bantering personalities to the solemn intuitions of eternity. And it is just this note of refined and free-ranging conversation that Jowett, by some gift of sympathy, has caught and transferred to his English. We seem not to be listeners among strange men in a remote age, but among men of modern London or Oxford discussing the ever old and ever new themes of justice and temperance and bravery and wisdom and the ways of God's high providence. If Jowett fails anywhere, it is in his rendering of some of the more poetical passages of the original, where for the moment the speaker is rapt out of the ordinary tone of conversation. At times Jowett is too little "literary"; but the fault is on the right side. Readers who have no Greek often ask how much of Plato can be got out of Jowett. They can get much, but not all. The chief obstacle in their way is the imperfect correspondence between the Greek ethical terms and their inevitable equivalents in any modern speech. Thus, *sôphrosunê* is commonly rendered by the English "temperance," and, indeed, no nearer equivalent is available. Yet "temperance" is very far from covering the full sense of the original, which conveys the notion of moderation, but embraces also the wider notion of the *mens sana in corpore sano* and is deeply colored by the peculiar graces of Hellenic life. There is no possible way to acquire the right feeling for such a word — and a vast amount of Plato's philosophy revolves about just such terms — except by long familiarity with it in its native setting. What can be done to transfer that setting to a new medium, Jowett, perhaps, has done; but he is not Plato, and English is not Greek.

PAUL ELMER MORE.

DIALYSIS, a physical process used principally by chemists for the separation of crystalloid elements contained in a mixture with colloids, the former being bodies which diffuse readily, such as sugar, salt, bichromate of potassium, etc.; the latter bodies which diffuse with difficulty or not at all, bodies resembling glue or gelatin, such as gum, starch, caramel, albumen, and many of the ordinary constituents of food. The dialysis is effected by pouring the mixed solution of crystalloid and colloid on a sheet of parchment or similar animal membrane stretched over a wood or gutta-percha hoop in the fashion of a tambourine. The parchment is allowed to float on a basin of water. In a short time all the crystalloid bodies will have passed through the membranous septum into the pure water, while the colloid matter will remain almost entirely in the dialyzer.

DIAMAGNETISM, the phenomena of repulsion under magnetic conditions, as contradistinguished from the attraction shown in the case of iron, nickel and cobalt in the presence of a magnet. The substances exhibiting such repulsion to the magnetic force are termed diamagnetics. At the head of the list, as showing diamagnetism in the greatest degree, is bismuth. Other diamagnetics, more or less strongly marked, are gold, silver, copper, zinc, lead, antimony, cadmium, mercury, iridium, uranium, tungsten and some others. See MAGNETISM.

DIAMANTE, dē'ą-mān'tā, **Juan Bautista,** Spanish dramatist: b. Madrid at what date is unknown; 1626, 1630 and 1640 have been suggested by various chroniclers. The date of his death is also unknown, but appears to have been previous to 1684. He was a knight of Saint John, and wrote about 50 plays. His earliest extant work is 'El honrador de su padre,' based on Corneille's 'Le Cid.' His most popular work was 'La Judía de Toledo,' a work which modern scholarship has shown to be only a slight redraught of 'La desgraciada Raquel' of Mira de Mescua. His plays were published in book form (2 vols., Madrid 1670, 1679). The 'Biblioteca de autores españoles' contains four of his plays. Consult Fée, A. L. A., 'Etudes sur l'ancien théâtre espagnol: les

trois Cid' (Paris 1873), and Rennert, H. A., 'Mira de Mescua et La Judia de Toledo' (in *Revue Hispanique*, Vol. VII, ib. 1900).

DIAMANTINA, Brazil, city lying somewhat north of the centre of the state of Minas Geraes, in a region formerly well known on account of its abundant production of diamonds. At the present time the wealth of the state is derived from agricultural and manufacturing industries; nevertheless Diamantina continues to prosper, being well situated with reference to the São Francisco River system, and the routes of travel between Rio de Janeiro and the interior. Its climate is good, owing to its elevation above sea-level (about 4,000 feet). It has an Episcopal seminary and numerous public buildings. It has cotton and leather manufactures, and also diamond-cutting and goldsmiths' establishments. Diamantina was founded in 1730. It formerly was called Tejuco. Pop. about 14,000.

DIAMENIA, genus of venomous snakes of Australia. See SERPENTS.

DIAMETER, a straight line drawn through the centre of a circle, and terminated both ways by the circumference. It thus divides the circle into two equal parts, and is the greatest chord. The radius is half this diameter, and consequently measures the distance between the centre and circumference of a circle. The length of the diameter is to the length of the circumference of the circle as 1 is to 3.14159265 . . ., the latter number being an interminable decimal. A diameter of a conic, in general, is the locus of the mid-points of a family of parallel chords, and is always a straight line. The one of the family of parallel chords that is also a diameter is said to be the conjugate diameter of the first one. See QUADRATURE OF THE CIRCLE.

DIAMOND, a natural form of carbon, highly valued as a precious stone when transparent and of the crystalline form. The diamond crystallizes in the cubic or monometric system, its common form being the regular octahedron or a modification of it. The faces are often curved and the general form of the crystal is more or less rounded. The surface of the diamond frequently exhibits striæ and triangular impressions, while the interior may contain microscopic cavities and various inclusions, often black carbon. It is the hardest substance known, but is cleavable; specific gravity, 3.52. It is generally colorless, but sometimes tinged with yellow, pink, red, orange, green, blue, brown or black. Blue, red and green are exceedingly rare colors. The finest deep red diamond known is that in the possession of the Russian Crown, purchased in the time of the Emperor Paul of Russia. Light yellow, straw and brown are the most common colors; rich yellow and browns are also highly prized. Some bluish-white Brazilian diamonds are phosphorescent in the dark after exposure to the sunlight. The color is attributed to the presence of a possible hydrocarbon, called Tiffanyite. This phosphorescence is a property peculiar also to alizarin. Exposed to the Roentgen or X-ray the diamond is transparent when radiographed, imitation diamonds appearing opaque. The diamond phosphoresces when exposed to roentgen rays, polonium or radium, retaining the light for some time. The brilliancy of the gem is caused by the planes reflecting all the light that strikes them at an angle exceeding 24 degrees 13 minutes. The index of refraction is 2.439, being exceeded only by that in chromate of lead and orpiment. The diamond is unaffected by any liquid and infusible at the highest attainable temperature. It gradually burns away at from 760° to 875° C., according to hardness, before the oxy-hydrogen blowpipe, or when heated and plunged into an atmosphere of oxygen, carbonic acid then being produced. Exposed to the intense heat of the voltaic arc, the diamond becomes converted into graphite at 3600° centigrade. Besides its value as a gem it is of great use in the arts and manufactures. Diamond dust is used for polishing other gems, for slicing gems of all kinds, agate, jade and other hard substances. A crystal with natural rounded edges is used by glaziers for cutting glass, for engraving glass, steel and other substances; the cut is generally to a depth of only 1-100 of an inch, but determines the direction in which the glass shall break; a cut of this depth, while scarcely showing, breaks well, whereas a deep scratch does not. Natural fragments or splinters or cleavages, either with the natural edge or sharpened to a point are used for engraving on glass and other hard substances; a splinter is also used as a tool for turning glass lenses in a lathe; and rough diamonds, too imperfect to be used as gems, are mounted as boring tools for perforating the softer rocks. The amorphous black variety, the carbon, carbonado, or bort, is used for boring hard rocks. Rock to the depth of a mile has been bored with this material. It sells for $90 a carat, the value per carat of a fine transparent rough diamond of from one to two carats, as often only 33⅓ to 40 per cent of the crystal is left in the gem after the operation of cutting.

The finest old East Indian, the Jägersfontein, the Rivers and the blue Wesselton diamonds are all of approximately one grade. The finest Jägers and the finest River diamonds are known as «extra-Jägers» and «extra Rivers» respectively. The Wesselton is the quality superior to a fine «Cape.» The Crystals, or fine Capes, as they are called, are of the first quality and always have a fine tint. The Silver Capes have a yellowish tint, while the Bywaters have a decided yellow tint. When the color is pure and rich yellow, it is known as «fancy yellow.» Diamonds from the Premier mine occasionally have the faint milkiness or cloudiness of the Brazilian diamonds. Bultfontein diamonds are steel in color and occasionally contain minute black carbon spots. No whiter diamonds were ever found, even in India, than are now found in the Jägersfontein, the Wesselton and Bultfontein mines.

Originally diamonds were preserved in their crystalline forms. But about 1300 A.D. in Europe, and perhaps earlier still in India, the art of polishing and shaping them seems to have been practised, and it was gradually perfected in the course of the ensuing centuries. Such an octahedral diamond set in a gold ring was found on the hand of Charlemagne at his tomb in Aix-la-chapelle. The invention of the cutting of regular facets by polishing the diamond on a rotating disk covered with diamond dust has been commonly attributed to Lodowyk van Berghem

of Bruges, in the latter part of the 15th century. These circular discs, about 30 centimetres in diameter, are of soft steel covered with diamond dust and oil, and made to revolve at 3,000 revolutions a minute. This gives the diamonds the artistic smooth surfaces and sharply defined edges. They are secured in a fusible metal *dop* or holder, held by a metal clamp to the wheel. The process is slow and tedious, and requires great skill to produce fine results. Until thirty years ago Amsterdam was the great diamond-cutting centre of the world, but the finest cutting is also done in the United States, and, in a great measure by machinery. As to the cutting process: Diamonds are, first, cleaved; that is, along the line of cleavage of the stone a tiny cut is made by scratching the stone with another diamond at the point where it is desired to cleave it, then a dull knife-edge is placed in the cut, and a sharp blow will separate the stone on a cleavage plane. More recently, they are sawed with thin circular blades of phosphor-bronze charged with diamond dust and oil. Secondly, diamonds are cut by rubbing two diamonds together ("diamond cut diamond," as the old adage says), the stones being cemented with shellac to two pieces of wood or handles which are held in the hands, and rubbed together till they are of the desired form. This also has been superseded partly by an American machine. The diamond-cutting trade is carried on by 8,000 cutters and over 30,000 people are employed in preparing and setting the gems. A "rose" diamond is one which is quite flat underneath, with its upper part cut into 12 or more little faces or facets, usually triangles, the uppermost of which terminates in a point. A "table" diamond is one which has a large rectangular face on the top, surrounded by four lesser rectangles. A "brilliant" diamond is one which is cut in faces both at top and bottom, including the table at the top and the culet at the bottom; there are 32 faces on the top above the girdle, and 24 on the back, 58 in all. Sometimes eight more facets are added making 64 in all. The greatest amount of brilliancy and beauty is developed in the diamond by the "brilliant cut"; 98 per cent of all modern diamonds are cut in this form. Very few are at present "rose-cut" or "table-cut," though the rose-cut has been more or less in vogue from the 17th century; the table-cut was favored during the 15th and 16th centuries.

Some of the square or oblong diamonds are brilliant-cut with pointed facets as on the other diamonds; but there is another type of cutting known as the "emerald cut," in which there are generally three rows of gallery — or degree-cutting, as it is termed — above the girdle, and they are degree-cut in the back. The *briolette* is a stone that is pear-shape, heart-shape, or irregular shape, and is covered entirely with minute facets. The *navette*, or marquise, are obovate-shaped, brilliant-cut diamonds. The cut is adapted to the color of the stone.

Diamond cutters vary as to the angle of the dome or the pavilion of the diamond. When measured from the table over the edge to the girdle they vary from 35 degrees to 38 degrees; when measured from the culet over the side to the girdle, from 40 degrees to 45 degrees, although generally 35 degrees for the top and 40 degrees for the back are the accepted measurements.

Nearly all diamonds are cut in the brilliant form. This was first used in France in the 17th century, under the influence and possibly at the suggestion of Cardinal Mazarin, who had a wonderful collection of diamonds which he bequeathed to the French Crown in 1661. Two of these Mazarins were sold at the sale of the French Crown jewels in 1887.

The combustibility of diamonds was proved in 1694 by Averani and Targioni with the aid of burning glasses. That diamonds turned to carbonic acid when burned was proved by Lavoisier in 1772. Many curious superstitions are connected with the diamond. It was supposed to show phenomena of sympathy and antipathy. It was fallaciously believed that the diamond, which resisted the two most powerful things in nature, iron and fire, might be dissolved by the blood of a goat; nevertheless, it could not be destroyed by being struck on an anvil, etc. It was believed also to show a curious rivalry with the magnet, to strengthen poisons, and sometimes to drive away madness.

That the diamond was known to the ancients is problematical; at most, occasional examples may have been brought to the Græco-Roman world about the beginning of our era. Two diamonds are mentioned by Castellani as being set in the eyes of an antique statue, but even this determination is doubtful. Therefore we may safely say that when the Prophet Jeremiah speaks of diamonds under the name of *Shamir* as tools for engraving, and when Ezekiel and Zechariah compare the stubbornness of the Israelites to the diamond, they refer to corundum. The same is true in almost all cases when the Greek and Latin writers allude to the *adamas* or adamant, the "unsubduable" stone. The small, uncut, octahedral diamond crystals set in a very few Roman rings of the 4th century of our era, to be seen in the British Museum, represent all the positive evidence we possess that the diamond was known to the European world in ancient times. Still there is a certain amount of indirect evidence that the diamond-point was used by some of the later Græco-Roman gem-engravers to a limited extent. The "point of a stone, more precious than gold" of the poet Manilius, who wrote in the 1st century A.D., has also been adduced as confirmatory testimony as to the importation of small Indian diamonds into the Roman world in early imperial times.

Authors and composers of Eastern tales long wrote of diamonds as being found in India only, and chiefly in the mines of Golconda — a misnomer, as Golconda was the market, not the mine; and diamonds from many mines were sold there. But ever since the year 1728 these stones have been found in great abundance in Brazil, no less than 1,146 ounces having been taken from there to Europe in 1730. In 1829 a few diamonds were discovered in the Ural Mountains; and in 1867, in South Africa, John O'Reilly, a trader and hunter, reached the junction of two rivers, and stopped for the night at the house of a farmer named Van Niekerk. Children were playing with some pebbles they had found in the river. O'Reilly took one of these pebbles to Dr. Atherstone at Cape Town, who said that it was a diamond of 22½

carats. It was sold for $3,000. Niekerk remembered that he had seen an immense stone in the hands of a Kaffir witch-doctor, who used it in his incantations. He found the man, gave him 500 sheep, horses and nearly all he possessed for the stone, and sold it the same day to an experienced diamond buyer for $56,000. This was the famous "Star" of South Africa. It weighed 85.77 metric carats in the rough, and was found to be a gem quite the rival of an Indian stone in purity and brillancy. After it had been cut it was bought by the Earl of Dudley, and is now known as the Dudley diamond. By 1869, parties in ox-wagons had worked their way over the plains to the Vaal River. Soon a tented city of 12,000 or more foreigners grew at Pniel and Klipdrift, on the opposite banks of the stream, where diamonds were found plentifully. Soon hundreds of cradles, like those used by the Australian gold-diggers, were rocking on the edge of the stream, supplied with the precious gravel by a large force of diggers, sievers and carriers.

The Kimberley, or De Beers mines, 600 miles from Cape Town, are immensely valuable, and the great Premier mine in the district of Pretoria, Transvaal, about 300 miles northeast of the Kimberley group, first worked in 1903, has in late years rivaled them in productivity; the New Jagersfontein mine, some 100 miles east of Kimberley, in the Orange Free State, is also a large producer. The total value of the diamonds mined in South Africa in 1913 was $55,000,000, and for the five-year period 1912–16, $160,000,000, in spite of the fact that in 1915, on account of the war, less than $2,000,000 worth of diamonds were extracted. In the year 1913–14, a single group of mines, those of the De Beers Company, comprising the Kimberley, De Beers, Wesselton and Dutoitspan mines, furnished diamonds worth $28,000,000. In the 10-year period 1904–13 this company paid dividends amounting to $93,000,000 on its stock, and although the Great War interrupted such payments for a time, they were resumed in 1916 when dividends of $6,000,000 were declared. The records of the other great South African diamond mining company, the Premier, show that for the entire period of its operation from 1903 to 1917, diamonds weighing 19,199,747 carats were recovered, their value being $87,083,224. The stock dividends paid in this time totaled nearly $14,000,000, on a total capitalization of £80,000 ($400,000).

The diamond fields of the Union of South Africa have produced in the half-century (up to 30 June 1917) since diamonds were first found in this region, stones worth the following enormous sums:

Transvaal	$98,141,150
Cape	702,596,679
Orange Free State	70,641,828
	$871,379,657

When we add to this the product of the German Southwest African mines, approximately $35,000,000, we have a grand total for all the African field of about $900,000,000. If we estimate the added value of the cut diamonds made from the rough crystals, and add a reasonable profit for the diamond dealers, there can be little doubt that these African diamonds were eventually sold for as much as $2,000,000,000.

LOADS OF BLUE GROUND WASHED, YIELD AND VALUE OF DIAMONDS FROM THE DE BEERS GROUP OF MINES, FROM 1888 TO 30 JUNE 1917.

	Loads of blue ground washed	Carats of diamonds	Value
Kimberley and De-Beers (1888–1917)	50,468,869	36,662,783½	$302,971,777
Wesselton (1897–1917)	32,047,389	9,437,008½	86,862,439
Bultfontein (1901–1917)	19,709,985	7,343,849½	71,667,251
Dutoitspan (1904–1917)	15,272,953	3,342,745½	75,198,367
Total	117,499,196	56,786,386½	$536,699,834

Most of the miners are natives who are kept in compounds for periods of from three to six months; this system has broken up the illicit diamond buyers ("I. D. B.") system, which seriously threatened the successful working of the mines. The chairman of the De Beers syndicate was Cecil J. Rhodes (q.v.), who by his genius and will created the corporation apparently out of chaos, and regulated the value of diamonds for over 12 years, the result being of great benefit to the jewelers of the world.

In 1908 a new diamond field was discovered in German Southwest Africa. Here the stones are found loosely scattered in a sandy overburden, and are believed to have been blown down, or washed down, from a region to the eastward. In 1913, the year before the war, about 1,500,000 carats of diamonds were recovered, and to sustain the price, the annual output was limited to 1,000,000 carats. The crystals are of good quality but almost all of them are very small. In 1914 the Great War put a check upon active operations in this region, although some mining has been done during the British occupation.

The first instance on the American continent of the occurrence of the diamond in the matrix — in its actual rock, peridotite — was described by the present writer as observed by him in Murfreesboro, Pike County, Arkansas, in 1906. More than two thousand diamonds to date have been found, one of over 16 carats, nearly all in the weathered debris of the peridotite rock and several of these in the rock itself. Diamonds have never been found in the original matrix in India or on the North or South American continents before this time.

More than a score of other localities in the United States have furnished in all several hundred diamonds weighing from 1 to 22 carats each, but *not one* of these was found in the matrix. California, North Carolina and Virginia have supplied a few, and in Ohio, Indiana and Wisconsin occasional finds have been made; the latter diamonds are traced to the glacial debris from Northwestern Canada.

Since 1867 diamonds invoiced at about $700,000,000 have been imported into the United States, and have been marketed as jewelry for as much as $1,500,000,000. There can be little doubt that the total value of the diamonds now owned in the whole world is approximately $3,000,000,000 and that those in the United States represent nearly $1,500,000,000 or about one-half of the world's diamond holdings.

The yields of the mines in the various diamond-bearing districts are approximately as follows:

India	$50,000,000
Brazil	150,000,000
German South West Africa	35,000,000
Borneo	1,000,000
South Africa (Transvaal, Cape Colony, Orange Free State)	900,000,000
Total	$1,136,000,000

which, after cutting and mounting, payment of duties and placing in the hands of customers, may well have cost $3,000,000,000.

Most of the great diamonds distinguished for beauty and size have very interesting histories. The most noted historic diamond is the Koh-i-nûr of the English Crown jewels. It has been generally identified with the diamond given to Humayûn, son of the Mogul Emperor Baber, shortly after the former's victory at Paniput, 26 April 1526. In his memoirs Baber relates that the diamond formerly belonged to Sultan Ala-ed-din, of the Khilji dynasty, who reigned over a great part of India from 1288 to 1321. There is a tradition that Ala-ed-din had taken it, about 1304, from a rajah of Malwa, in whose family it had been an heirloom for centuries. The legend runs that it was worn nearly 5,000 years ago by the hero Karna, whose deeds are celebrated in the "Mahabharata." It is believed to have been guarded among the Mogul treasures of Delhi until 1739, when it was carried off as part of his immense plunder by the Persian Nadir Shah. After Nadir's death it was yielded by his weak successor, Shah Rukh, to the Afghan chief Ahmed in 1751. The latter's descendant, Shah Shuja, was forced to give it to Runjit Singh, the Lion of the Punjab, and in 1849 it was surrendered to the East India Company, whose directors presented it to Queen Victoria. The Koh-i-nûr was shown to admiring crowds at the London Exhibition of 1851. Its weight in its Indian cutting was 186 1/16 of the old carats (191.10 metric carats), but after it had been recut in London in 1852 the weight was reduced to 108⅓ metric carats.

The largest Indian-cut diamond was the Great Mogul, which weighed in the rough 817 metric carats (793⅝ old French carats), but was reduced in weight to 287½ metric carats by the unskilful cutting of a Venetian lapidary. It was probably found about 1650. It was seen by the great French gem-dealer Tavernier at the court of Aurengzeb in Delhi in 1666, and is believed to have later formed part of Nadir Shah's booty. As there is no definite historic notice of it since Tavernier's time, this great diamond must either have been lost or else cut up into two or more smaller ones. Next in size among the Indian diamonds seen by Tavernier was a table-cut stone weighing 242 5/16 carats (249.46 metric carats). All trace of this diamond also seems to have been lost, although it may possibly be hidden away in the very mysterious Persian treasury, to which belong the "Darya-i-nûr" (Gem of Light), weighing 191 metric carats, and the "Taj-e-mah" (Crown of the Moon), which weighs 150 metric carats.

One of the finest Indian-cut diamonds is that named the Sancy, after the Huguenot nobleman Nicholas Harley de Sancy, who owned it toward the end of the 16th century. There is a romantic tale to the effect that at the request of Henry III of France, Sancy sent this diamond to the Swiss as pledge for the payment of a body of mercenaries. The messenger to whom he entrusted it was attacked and murdered, but instead of giving up the diamond swallowed it. Sancy had the body opened and found the gem in the faithful man's stomach. This diamond was sold to James I of England in 1604, and was one of the Crown jewels taken to the Continent by Queen Henrietta Maria in 1642 to raise funds for Charles I. It eventually came into the possession of Cardinal Mazarin, who bequeathed it with 17 other fine diamonds to the French Crown in 1661. In 1722 Louis XV wore it at his coronation. It disappeared from France during the Revolution and passed through various hands, being acquired in 1865 by the rich Parsee merchant Sir Jamsetjee Jeejeebhoy. Later the Maharaja of Puttiala owned it. It now belongs to the son of Viscount Astor.

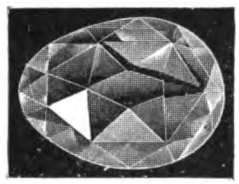
Regarding the early history of the Orlov many strange tales have been related, among others that it had formed one of the eyes of a Hindu idol in a temple on the island of Sriran-gam, Mysore, whence it had been stolen by a French grenadier. It almost certainly belonged to the Persian Nadir Shah, and was probably part of the immense plunder he carried off from Delhi in 1739. After his assassination in 1747 the diamond was sold by one of his Afghan soldiers to an Armenian merchant, who eventually disposed of it in 1775 to Count Orlov for 1,400,000 florins ($560,000) and a patent of nobility. The count gave it to Catharine II of Russia. The "Orlov" weighs 194¾ of the older carats (199.73 metric carats). A much smaller Russian diamond is the "Polar Star," a brilliant weighing 40 carats (41.08 metric carats). Of precisely the same weight is the diamond called the "Pasha of Egypt" bought of Ibrahim Pasha for $140,000.

The "Régent" or "Pitt" diamond was the great diamond of the French Crown jewels. It was bought in India by Thomas Pitt, governor of Fort Saint George, Madras, in 1701. Pitt sent the stone to England for cutting, its weight being reduced by this operation from 410 carats (422.10 metric carats) to 136⅞ carats (140.64 metric carats). After considerable negotiation Pitt sold his diamond to the Régent Orléans for £135,000 (about $675,000). It was stolen from the Tuileries in 1792, but was soon recovered. Later on it was pawned in Berlin and then in Amsterdam to raise money for the Republican army. During the Empire it adorned the hilt of Napoleon's sword. The Régent was reserved for the state when the greater part of the French Crown jewels were sold in 1887, and has been placed in the Louvre Museum.

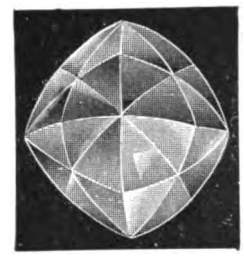
The famous Florentine diamond, now in Vienna, is an Indian-cut stone, acquired in the early part of the 17th century by the Grand Duke of Tuscany. After 1745, when Grand Duke Franz Stephan, husband of Empress Maria Theresa of Austria, was crowned emperor of Germany, this diamond entered the Imperial Austrian Treasury. It weighs 137.27 metric carats (133¾ of the older carats) and is of a yellowish hue. The assertion has often been made that it originally belonged to Charles the Bold of Burgundy, but there is no convincing evidence of this.

The celebrated blue diamond of the French Crown jewels, valued in 1791 at $600,000, was

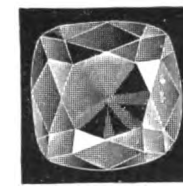
DIAMONDS



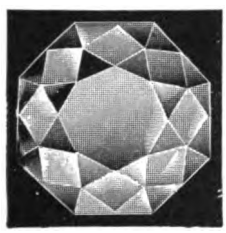
The Sancy



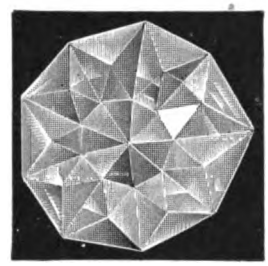
Natural Crystal



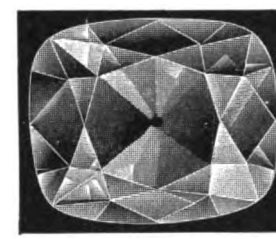
The Polar Star



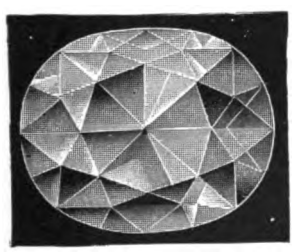
The Pasha of Egypt



Florentine Crystal

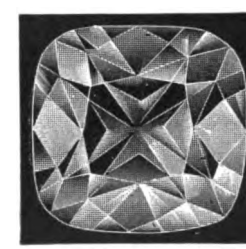


Star of the South

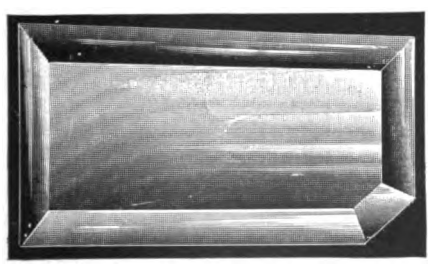


The Kohinur

The Great Mogul

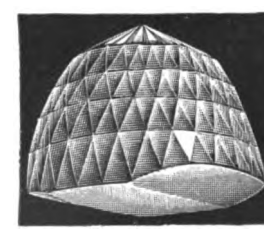


The Regent or Pitt



Great Table Stone of India

The Shah



The Orloff

cut from a rough diamond of 115½ metric carats sold by Tavernier to Louis XIV in 1668. When cut as a brilliant it weighed 67⅛ carats (69.1 metric carats). It disappeared in the troubles of 1792. The splendid sapphire-blue brilliant, known as the Hope diamond, weighs 45.52 metric carats. In the Russian Treasury is a fine red brilliant-cut diamond weighing 10 carats; this was acquired during the reign of Emperor Paul. The collection in the "Green Vaults" in Dresden, Saxony, includes a diamond of greenish hue weighing 41.1 metric carats.

A most interesting historic diamond is that called the "Shah," given in 1829 by Prince Khusrau of Persia to Emperor Nicholas I to placate the tsar for the murder in Teheran of the Russian Ambassador. On polished faces of the crystal were engraved the names of Akbar Shah, Nisim Shah and Fath Ali Shah; the latter began his reign in 1797. The weight of the "Shah" is 86 carats (88.19 metric carats).

The largest and finest brilliant in the world to-day is one cut from the great Cullinan crystal found in the Premier mine in the Transvaal in 1905, and which weighed in the rough 3,106 metric carats. This crystal was presented in 1907 by the Union of South Africa to King Edward VII, and was cut into several gems in Amsterdam in the following year. The largest of these, which outranks all other brilliants, is called "Star of South Africa"; its weight is 530.2 metric carats. Another brilliant, from the same crystal, bears the name "Lesser Star of Africa," and weighs 317½ metric carats; this stone ranks second among the world's brilliants. Next to these in size, among the South African diamonds, is the "Jubilee," weighing 245 metric carats (239 of the older carats); before cutting it weighed 634 carats (650.81 metric carats). In 1893 the Jagersfontein mine supplied what was until then the largest diamond crystal ever found, the "Excelsior," of 995 2/5 metric carats (969½ of the older carats). This was cut up into 10 brilliants, ranging in weight from 13.87 to 68.70 metric carats. Another large African diamond is that called the "Victoria," weighing 457½ carats (469.88 metric carats) in the rough and 184.77 metric carats as a brilliant. It was purchased by the late Nizam of Hyderabad for $2,000,000. Still another noteworthy African diamond is the "Tiffany Yellow" found in the Kimberley mine in 1877. In the rough it weighed 280 of the older carats (287.43 metric carats); in its present brilliant form its weight is 128.51 metric carats.

The largest diamond crystal in the world, as the Cullinan has been divided into several pieces, would be that called the "Braganza," now in the Portuguese treasury, providing it were a genuine diamond; but grave doubts have been expressed in regard to this and it has not been shown for over one century. The stone comes from Brazil, and must have been found prior to 1746. Perhaps the fact that the Braganza diamond was never submitted to expert examination has contributed as much as anything else to the conjecture that it may be only a topaz. According to description, the stone is of a pronounced yellow shade, its form being oblong and rounded, with a depression on one side, but an illustration in the *Gentleman's Magazine* of 1754 shows a rounded egg-shaped stone, suggesting an elongated rolled pebble; in other words a white topaz pebble and not a diamond. It weighs 1,680 carats (1,728.72 metric carats). The diamond brilliant known as the "Regent" of Portugal, found in Brazil in 1775, weighs 215 carats (221.25 metric carats). Next in size among Brazilian diamonds is the "Star of the South," found by a negress in the river Bagagem in 1853. In the rough it weighed 261.37 metric carats, and when cut as a brilliant 128.83 metric carats (125½ of the older carats). It was sold to the Gaekwar of Baroda for $450,000.

From 1750 to 1870 the value of a diamond was fixed on a basis of the square of its weight; that is, a 1-carat stone was worth $100, a 10-carat stone was worth — 10 x 10 x 100 — $10,000. This was due to the fact that large stones were rare. But in the African mines, large stones are found, and the increase in value from one carat up is worth only a fraction more per carat than the carat weight would show. When brilliants are exceedingly minute the value per carat may be double that of stones weighing one-sixteenth to one-fourth carat each, owing to the difficulty of cutting. The term "first quality" signifies a stone absolutely white and free from all flaws and imperfections. Imperfections, even if slight, or a tint of undesirable colors, greatly lower the value of a diamond. Many are cut so small that they weigh from 200 to 400 to the carat or 30,000 to 60,000 to the ounce.

Since 1910 a radical change has been made in the weighing of diamonds and all precious stones, the standard now being a "metric carat" of 200 milligrams, divided into hundredths in conformity with the decimal system; this change was already suggested by the present writer as far back as 1893.* This new carat, which is the one now used in all European and American countries, is equivalent in weight to 3.08647 grains. It was officially adopted in the United States, 1 July 1913.

As the diamond is known to be a crystalline form of common carbon, many attempts have been made to manufacture it by artificial means. No great degree of success has yet rewarded these efforts, although very small diamonds of apparently good quality can be prepared by methods now known. Carbon being practically infusible, it has not been found feasible to induce crystallization by causing the carbon to solidify from a molten condition. Free carbon is soluble in but few substances, and from such solutions as can be prepared it is deposited mainly in the form of graphite. It dissolves to a considerable extent in melted platinum, but when the metal is allowed to cool and solidify, the carbon is all thrown down as graphite, and no diamonds are obtained. Of the more successful experiments of this sort, those of Moissan are best known. Moissan made use of the known fact that carbon will dissolve to some extent in melted iron. Under ordinary conditions the carbon is here also deposited in the graphitic form; but Moissan found that when the solution is allowed to cool under an exceedingly great pressure a small portion of it appears in the form of minute crystals that possess all the properties of the true diamond, even exhibiting the peculiar pittings on the surface that are

*At the International Congress of Weights and Measures, Chicago, 1893.

characteristic of the natural stone. His method consists in saturating the molten iron with carbon and then pouring it into a mold and chilling the casting as quickly as possible by immersing it in water. The outer layers solidify under this treatment, while the interior is still quite fluid, and the powerful contraction of the surface gives rise to an enormous internal pressure. As the fluid core solidifies, the greater portion of the carbon that it contains is deposited in particles that are distributed throughout the mass. The casting, when entirely cold, is dissolved in acids, and the residue is treated in various ways to effect the removal of the graphite and amorphous carbon. A small precipitate remains behind, in which tiny crystals of diamond may be distinguished. No stones that are large enough to be of commercial value have yet been prepared, and while the process is of great theoretical interest, it is far too expensive, in comparison with the yield, to be practicable even for the manufacture of diamond powder for polishing and grinding purposes. Moissan's 200 experiments, costing $2,000, yielded one-half carat of diamond powder worth $1.

Minute diamonds have occasionally been found in meteorites, as in that from Cañon Diablo, Arizona, at the American Museum of Natural History, New York city. This was one of the earliest instances of diamond identification in a meteorite, the discovery having been made by Dr. G. A. Kœnig, in 1891. The first find in a meteorite was made in 1888 by the Russian scientists Jerofeyev and Lachinov, in the case of one that fell, in 1886, three miles from the village of Novo-Ursi, in the government of Perm, Russia. A piece of the meteorite from Cañon Diablo was dissolved with hydrochloric acid, separating the diamond dust, some of which was used under the direction of the present writer to polish several terrestrial diamonds, this being the very first instance of the polishing of an earth-born diamond by the dust of one dropped from the sky. One of these two stones is to be seen in the collection of the American Museum of Natural History.

These meteorites and diamonds were called to the attention of Dr. Henri Moissan by the present writer, and led to his further experiments and to the discovery of moissanite (named by the present writer) — a silicide of carbon having the hardness 9.5, next to the diamond. See GEMS; PRECIOUS STONES.

GEORGE F. KUNZ.

DIAMOND, Cape. See CAPE DIAMOND.

DIAMONDBACK TERRAPIN (*Malaclemmys palustris*). This far-famed turtle belongs to the family *Emydidæ* and may be recognized by the unhinged plastron or lower shell, the concentric grooves and ridges which mark each plate of the upper shell or carapace, the smooth unnotched jaws, smooth skin covering the head, and dark olive or black color. Unlike most terrapins, the diamondback inhabits salt and brackish waters, living in the marshes which fringe our seacoast from Cape Cod to Texas. Formerly very abundant throughout this region, the constant extensive fishing to supply the markets has greatly reduced its numbers, so that the problem of its artificial propagation is now being taken up seriously. The principal fisheries are in Chesapeake Bay and on the coasts of New Jersey and North Carolina. Although a considerable number are dug from the mud while hibernating, a much larger proportion are captured by means of traps, seines, etc., during the summer months, and are confined in pens, where they are fed on oysters, fish, and celery to fatten them for the winter market. From the point of view of the epicure, the diamondback is perhaps the most famous and esteemed product of American waters, and during the season of greatest demand commands almost fabulous prices. Those commonly sold have a length of shell of from five to eight inches, and are supposed to be from 6 to 10 years old. The habits differ but little from those of other terrapins. They are omnivorous, lay their eggs in June and July in small nests excavated in some warm sandy bank, and hibernate during the winter after burying themselves a few inches beneath the mud. See TURTLES.

DIAMOND-BEETLE, the *Entimus imperialis,* a splendid coleopterous insect belonging to the family *Curculionidæ* or weevils. The ground color is black, but the insect is covered by a large number of scales which appear brilliantly green by reflected light. It is very abundant in some parts of South America.

DIAMOND-BIRD, an Australian bird (*Pardalotus affinis*), of beautiful plumage, receiving its English name from the peculiar markings of its feathers. Its general color is gray and white, but spotted with red, yellow, orange, and black. It makes its nest in old tree-trunks, and sometimes burrows in the ground, or utilizes any chance excavation. It feeds on insects.

DIAMOND GAUGE, a gauge for estimating the size of diamonds. In the staff are set crystals of graduated size, by which jewels are compared. The crystals are from one-quarter to one-sixty-fourth of a carat.

DIAMOND INDUSTRY, a most important and far-reaching department of national and international commerce, which is spreading and increasing, year by year, especially in the United States. The diamond has been a precious stone procured with difficulty, treasured up with jealous care, and sought after by the rich and magnificent for ages. Diamonds are also indispensable for instruments employed in some of the manufacturing and industrial arts. A consideration of the diamond industry must include an account of the mining, polishing, importation, and sale of this gem. The distribution of diamonds in the geological formations of the world, their mining, etc., has been dwelt upon under the article DIAMOND (q.v.). It remains to point out some recent industrial facts of importance, with regard to the separation of diamonds from the concentrates, which remain when the diamentiferous earth has been washed, after being brought to the surface at Kimberley; their importation to this country, and their artificial manufacture. In mining diamonds, it was necessary until recently to go very carefully over the concentrates to pick out the garnets and many other foreign substances until nothing remained but the rough diamonds. This is a slow and laborious operation, but it has been an essential part of the mining industry until it was superseded by

a discovery made a while ago. The discoverer was Mr. Fred Kersten, one of the employees in the sorting room. His discovery was accidental. A rough diamond and a garnet happened to be lying on a small board on the bench where he was working. He happened to pick up one end of the board when the garnet glided off, but the diamond remained. Kertsen found that there was a coating of grease on the board which had retained the diamond, while the garnet slipped off. He procured a wider board, coated one side of it with grease and dumped a few handfuls of concentrates on it. Then he found that by holding the board in a slightly inclined position and vibrating it, all the concentrates except the diamonds moved to the lower end and fell off while the diamonds remained in place. Then he invented a machine by which his discovery might be utilized. The invention was an entire success. All the garnets and other minerals that are not wanted pass over the surface of the table, while every diamond, large or small, is retained. The entire work is now done by machinery, and both the young inventor and the owners of the diamond mines are profiting by the new labor-saving device. The United States is a very large purchaser of diamonds. One-third of the entire amount of cut stones is owned in this country. The importations are increasing.

More than $49,529,845 worth of diamonds and precious stones were brought into the United States in 1912–13 according to the statistics of the Department of Commerce and Labor. This is the largest importation of diamonds and precious stones in a single year; since that date there has been a falling off, due to the war. Prior to 1887 the total had seldom, if ever, reached $10,000,000 per annum; from 1887 to 1893 the total gradually moved upward until it reached $16,000,000; then it rapidly fell to $5,500,000 in 1894, $7,500,000 in 1895, $6,750,000 in 1896, and $2,500,000 in the fiscal year 1897. In 1898 the total increased to nearly $9,000,000, in 1899 to over $14,000,000, in 1901 to $20,000,000, in 1902 to $23,000,000, and in 1903 it was about $30,000,000, making the total for the year 1903 not only more than in any preceding year, but 50 per cent in excess of 1901, double the figures in 1899, and more than six times the average during the period 1894–97.

The rapid growth in the importation of diamonds, while it suggests general prosperity, also seems to indicate the development of a comparatively new industry in the United States — the cutting of diamonds. The total importations of diamonds alone in the 12 months ended with June 1910 amounted to $39,812,214, and of other precious stones $7,987,587. Of the $39,812,214 worth of diamonds imported, $10,232,604 were uncut diamonds; this total of $10,000,000 of uncut diamonds is a large increase compared with the importations of uncut diamonds in preceding years. However, in 1913–14 the importation of diamonds fell to a total of $25,314,787, of which $8,314,688 were uncut. In 1914–15 the importation was still less, due to war conditions.

The diamonds imported are divided by the bureau of statistics statements into two groups, namely: "Diamonds uncut, including miners', glaziers', and engravers', not set," and "Diamonds cut, but not set." The value of diamonds uncut, including miners', glaziers', etc., imported in 11 months ended with May has grown from $2,500,000 in 1898 to $10,000,000 in 1910, while that of diamonds cut but not set has grown from $4,000,000 in 1898 to $29,500,000 in 1910, these figures being in each case for the period of 11 months. This inference that the cutting of diamonds is becoming an important industry in the United States is strengthened by the fact that the census statistics of "lapidary work" show that the total value of production of lapidary work in 1905 was over $7,600,000 against less than $500,000 in 1890, and that the value of the materials used in this work in 1905 was over $6,200,000 against less than $250,000 in 1890.

It is indeed worthy of note that although the largest percentage of diamonds is cut outside of the United States, and all of them mined in other countries, the most improved machinery and many of the patented devices for mining and cutting have been the products of American ingenuity. Even Gardner F. Williams is an American born and bred.

Although the annual production of diamonds has increased more than 1,500 per cent in the last 30 years, and though there are produced at the present time more than 3,000,000 carats annually as against 200,000 before the discovery in South Africa, the changed condition has come about in such a manner that the stone has not been cheapened in value, has been fixed on a more even market basis, and has that much enriched the world.

The cutting branch of the industry has almost doubled in the past eight years, and now keeps employed between 700 and 800 men. Nearly five-sevenths of the diamond cutting of the world is done in Amsterdam and Antwerp, though New York has recently begun to make its influence felt in that direction. There are a number of cutting establishments in New York and Brooklyn, employing from 40 to 80 men each, and although the wages paid to American workmen are much higher than those paid in Europe, the advantage of better machinery in this country averages the cost of cutting. This is especially true in regard to large stones, though not always so with respect to stones running below an eighth of a carat.

Details of the artificial manufacture of diamonds in an electric furnace by Prof. Henri Moissan, at the University of Paris, were published in June 1903. His experiments were begun after his finding of microscopic diamonds in nature, in the "blue earth" from the Cape, in the sands of Brazil, and in several meteorites. His researches showed that if carbon was produced at low temperatures it was always obtained in the amorphous condition and no crystals were found. The details of the manufacture are thus described:

"For his experiment, Professor Moissan utilized the pressure which is produced in iron when it passes from the liquid to the solid state. It is known in fact that solid iron is less dense than when in fusion, as is shown by the fact that pieces of the metal will float on the melted bath, and it thus resembles water in this respect. He melts the iron in the electric furnace and saturates it with carbon, and to carry this out 200 grammes of Swedish iron cut into cylinders half an inch long and two-fifths inch diameter were placed in a carbon crucible and completely covered with powdered charcoal. The crucible was placed under the arc and heated during three to six minutes with

a current of 350 amperes at 600 volts. The cover of the furnace was removed and the crucible seized with a pair of tongs and plunged quickly into a bath of cold water. The crucible and metal remain red for a few moments, giving off gases which come to the top, then the whole cools off. It was not without apprehension that the experiment was made for the first time, as it was feared that an explosion would be produced when the melted mass at 3,000 degrees came in contact with the cold water. But no bad effect is produced by the meeting of the hot mass and the liquid; and during the first period the mass is cooled rather by a rapid radiation. In order to cool it by conduction, and thus more quickly, it was placed in iron filings. In this way the diamonds which were obtained were of a peculiar nature, and they contained specks of black carbon. The pressure seems to be less, and the transformation of the carbon into the diamond is less complete. The experiment is, however, highly instructive, as it gives a form of speckled diamond which is also found in nature. To obtain a more rapid cooling, a bath of melted lead was found the best; it was kept at about the fusing point, or 617° F. The crucible, heated as before, is quickly plunged into the bath of melted lead, which is about six inches deep. The iron, which is lighter than the melted lead, is detached from the crucible in masses which tend to form spheres and rise more or less rapidly to the top. When the iron is saturated with carbon in the furnace, it becomes so pasty that the crucible can be turned over and it will not run out, but when it cools off the metal soon becomes liquid and gives up graphite.

"The smallest spheres, half an inch in diameter, were solid and sufficiently cool on coming to the top. These spheres gave a good yield of diamonds and the latter were especially clear and brilliant, and the spotted form was absent. Some of the crystalline forms were very sharp. One of the transparent diamonds measured as high as 0.57 millimetre, and had a somewhat triangular form with the angles rounded off. It was perfectly clear. It is curious to note that three months after its formation it split into two pieces; this fact is significant, as some diamonds from the Cape show an identical action, this being no doubt due to irregularities of pressure at the time of formation. The samples of diamonds obtained by this method were interesting to examine as to their different form. Most of them were smooth and brilliant, while others had a grained surface. All the specimens had the particular lustre which is characteristic of the native diamond. When a ray of light is sent into the interior they appear to become luminous. Some of the specimens are cubes and octahedra, with rounded angles." See DIAMOND.

DIAMOND JOUSTS, jousts instituted by King Arthur, "who (according to the Arthuric legend as set forth by Tennyson) by that name had named them since a diamond was the prize." Before he was king he came by accident to a glen in Lyonnesse, where two brothers had met in combat. Each was slain; but one had worn a crown of diamonds which Arthur picked up, and when he became king offered the nine diamonds as the prizes at nine several jousts, "one every year, a joust for one." Lancelot had won eight and intended to present them all to the queen, "when all were won." When the knight at last laid them all at her feet, Guinevere, in a jealous rage, flung them out of the palace window into the river.

DIAMOND NECKLACE, a jewel the incidents connected with which have furnished materials for one of the best historical romances of the Dumas. This necklace contained 500 diamonds, was valued at some $40,000, and was made by order of Louis XV for his mistress, Madame Du Barry. The necklace was not finished in the king's lifetime, and after his death the Du Barry was banished. Between the years 1783 and 1784 the charms of Queen Marie Antoinette had infatuated the Prince-Cardinal Rohan, who was led to believe, by the so-called Countess Jeanne de Lamotte-Valois, an unprincipaled adventuress, that the queen reciprocated his feelings. The cardinal was informed that the queen was anxious to purchase the diamond necklace and wished for him to become surety for the price to the makers, MM. Boehmer and Bassauger. The cardinal agreed to become security, the necklace was delivered, but never reached the queen. Jeanne de Lamotte and her husband, meanwhile, had disappeared from Paris, and were selling the diamonds in parcels. The plot was discovered when the jewelers went to court complaining that the necklace had not been paid for. The cardinal and others concerned were thrown into prison. As the trial established rather the folly than guilt of any one excepting the Countess Lamotte, she and her husband were branded on the shoulders as thieves, and sentenced to life imprisonment. The resultant scandal greatly aggravated that popular rage which terminated in the French Revolution.

DIAMOND RATTLESNAKE. See RATTLESNAKE.

DIAMOND SNAKE, an Australian python regarded by most naturalists as a variety of the carpet-snake (q.v.).

DIAMOND STATE. The popular name of the State of Delaware (q.v.).

DIAMOND WEDDING, the celebration of the 75th anniversary of a wedding, at which presents of diamonds are given. Other anniversary weddings sometimes celebrated are paper, wooden, tin, crystal, and china weddings, namely, on the 1st, 5th, 10th, 15th, and 20th anniversaries; while silver and golden weddings are celebrated on the 25th and 50th, respectively, presents being made to the bride of the material indicated in the title.

DIANA, a goddess of Italy whom the Romans subsequently identified with the Greek Artemis (q.v.). Diana was the protectress of slaves, who held a yearly festival in her honor. She was a virgin and no man was permitted to enter her temple. She dwelt in the groves and near wells. Madness and enthusiasm might be aroused in the hearts of men by this goddess. She was also the goddess of the moon, which fact accounts for her identification with the Greek moon-goddess, Artemis. She seems to have been originally the patron deity of the Sabines and Latins. Her temple stood on the Aventine and was built by Servius Tullius for the benefit of the Latin people. It seems probable that the worship of Diana was introduced at Rome by the Sabines and the Latins on the

occasion of the admission of these peoples to the plebiscite.

DIANA. One of the few readable pastoral romances is the Spanish 'Diana' (1558) by the Portuguese Jorge de Montemŏr, whose name is usually given in its Spanish form as Montemayor. The pastoral tradition, taking its rise in the 'Idyls' of Theocritus, the 'Eclogues' of Virgil, and the late Greek story of 'Daphnis and Chloe,' had been developed by Renaissance Italy in two directions, one dramatic, the other narrative. The best representative of the narrative type had been the 'Arcadia' of Jacopo Sannazaro (1502) (q.v.). From this work and from Spanish and Portuguese pastorals — especially the 'Menina e Moça' (1554) of Bernardim Ribeiro — Montemayor drew inspiration for a tale in prose and verse that should set forth his personal disappointment in love, thinly disguising folk of a courtly world as moody rustics. His scene was no longer a literary Arcadia of conventional beauty in a time remote, but the Spain and Portugal of his own day. His prose was allowed larger room than in the narrative of Sannazaro; and it was more carefully wrought, more pictorial, more vigorous. In spirit, the 'Diana,' like its prototype, displayed an urban interest in the life of nature, but the longing for an Age of Gold, so frustrate and bitter in Sannazaro, was here absent. The drifting plot was better anchored, and the ideal of love was amplified.

Diana is a shepherdess in the fields of Leon admired by Silvano, whom she scorns, and by Sireno (the author), whom she approves. But Sireno, forced to be absent for a year, returns to find her wedded to Delio, a second rival, and to mingle his tears with those of Silvano, whom once he had feared. The woes of unrequited affection are thereafter portrayed, not only in Sireno's case, but in that of Selvaggia and a whole chain of shepherds and shepherdesses loving at cross purposes. Eventually they find surcease of woe in drinking a magic potion that induces in their breasts a love requiting and requited, the situation somewhat resembling that in 'A Midsummer Night's Dream.' There are various inserted episodes, the most famous being the story of Felix and Felismena, which suggested to Shakespeare part of the plot for his 'Two Gentlemen of Verona.'

Montemayor's fiction, left unfinished at his death in 1561, was continued three years later by Alonso Pérez and much more agreeably by Gaspar Gil Polo, whose 'Diana Enamorada' ranks little below the original. The Spanish rage for pastorals affected Cervantes and Lope de Vega, and touched the English, who were introduced to the 'Diana' and its sequels in a translation by Bartholomew Young in 1598. Frenchmen felt its influence even more through 'L'Astrée' of Honoré d'Urfé, issued in several parts from 1608 to 1624. Three contributions in particular the 'Diana' made to the development of prose fiction: first, it moved later writers to give rein to their feeling for landscape and their sense of nature's sympathy with man; second, it pointed the way toward the analysis of love, a love romantic and absorbing, but introspective and sentimental rather than impassioned; and, third, it taught a more aristocratic and gallant style than that of the romances of chivalry, offering models of courtly speech. For further information concerning the 'Diana,' the English reader is referred to F. M. Warren's 'History of the Novel Previous to the Seventeenth Century' (1895), and to H. A. Rennert's 'Spanish Pastoral Romances' (1892).

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DIANA, Temple of, a splendid structure and one of the glories of the ancient world, erected at Ephesus in Asia Minor. It was erected at public cost in the year 620 B.C. and became a place of pilgrimage for all Asia Minor and Greece. Its architecture was remarkable for its period and was very rich in the interior. It was 129 metres long and 66 in width and was supported by 122 columns. At the end was erected the golden statue of Diana Artemis. Chersiphron of Cnossus conceived the plan of the temple and supervised its construction and his son, Metagenes, continued the work. Crœsus was a liberal contributor to the fund for its construction. In 356 B.C. the temple was burned by Erostratus, who wished to gain immortality through his act. Dinocrates superintended the reconstruction and it was this restored edifice which was one of the seven wonders of the ancient world. It was plundered by the Scythians in 263 and was definitely ruined by them. Archæologists within the last 100 years have discovered traces of earlier temples on this site, notably by J. T. Wood in 1860–75 and by Hogarth in 1904–05. Fragments of the sculpture and some coins and other treasures unearthed by Hogarth now lie in the British Museum. Consult Ferguson, 'Temple of Diana at Ephesus,' in transactions of the Royal Institute of British Architects (London 1883); Hogarth, 'Excavations at Ephesus' (2 vols., ib. 1908); Wood, J. T., 'Discoveries of Ephesus' (ib. 1876).

DIANA OF THE CROSSWAYS. This novel by George Meredith is a penetrating study of feminine character in its marital and social relations. Diana, as Meredith proclaims, is "a positive heroine, with brains and real blood." Her youthful, loveless and unhappy marriage, her reckless plunge into the gaieties of London life, her impulsive and disastrous association with various public men, and her final union, after the death of her first husband, with the unassuming but substantial Redworth, constitute the basis of a brilliant presentation of English society and a delicate and subtle analysis of human nature. The heroine, we are informed in one of Meredith's letters, is modeled after Mrs. Norton, a granddaughter of Sheridan, and many of Diana's experiences resemble those of her prototype. But the central incident of the novel, Diana's sale of a political secret to the editor of a famous newspaper, was founded not upon fact, but upon rumor since disproved. In spite of certain flaws and inconsistencies in the delineation of the leading character — her dereliction in the crisis of her career is never quite reconciled with her asserted intellectual discernment — the novel is one of the best balanced of Meredith's contributions to English fiction. It is packed with thought, yet it is entertaining; it is sparkling with wit, yet its brilliance of expression is not so excessive as to be blinding; it is epigrammatic without being cryptic. The inspiring conception of womanhood embodied in the heroine, — strong, independent, courageous, witty, without sacrifice of

charm and lovableness — should be pondered by all to whom the Victorian heroine is a namby-pamby emotionalist. The incisive discussion in the opening chapter of sentimentalism and sham realism should be studied by all who would gain discrimination in the judgment of fiction. An incomplete version, the basis of certain American editions, ran in *The Fortnightly Review* from June to December 1884. The enlarged and completed work was published in 1885. Consult Meredith's 'Letters,' edited by his son (London 1912); Henderson, M. Sturge. 'George Meredith' (London 1907); *The Nation* (Vol. XCV, p. 306; ib., pp. 328–329).

GEORGE B. DUTTON.

DIANA OF FRANCE, Duchess of Montmorency and Angoulême: b. Piedmont 1538; d. 3 Jan. 1619. She was a natural daughter of Henry II; was formally legitimized, and married first to a son of the Duke of Parma, next to the eldest son of the Constable de Montmorency. She enjoyed great influence at court under Henry IV, superintended the education of the young prince, afterward Louis XIII, and then retired from court.

DIANA OF POITIERS, pwä'tē-ā, Comtesse de Brézé, Duchesse de Valentinois: b. 1499; d. 1566. At the age of 13 she married the Count of Maulevrier, Grand Seneschal of Normandy. She became in 1538 the mistress of King Henry II of France, in whose name she ruled with unlimited power. Till his death in 1559 she exercised such an absolute empire over the king by the charms of her wit and grace that her superstitious contemporaries ascribed her power to magic. Upon his death she retired to her castle Anet, where she established a charitable institution for the support of 12 widows. Medals are still to be seen bearing her image, trampling under foot the god of love, with the inscription, *Ominum victorem vici* (I have conquered the universal conqueror).

DIANA MONKEY, a monkey (*Cercopithecus diana*), native to the west coast of Africa. Its name is given because it bears on its forehead a crescent of upright white hairs, suggestive of the new moon, which was the emblem of the Greek goddess Diana. It is black in color, streaked with brown down the back; the fore parts are pure white, as also is the long beard. It is gentle and easily tamed, but is not strong enough to endure captivity and change of climate. Hence the specimens sent to menageries usually die within a short time.

DIANA'S TREE (*Arbor Dianæ*), silver tree, is formed from a solution of silver in nitric acid, precipitated by quicksilver, and crystallized in prismatic needles which are grouped together in the form of a tree. To make this beautiful process visible, let a quantity of pure silver be dissolved in nitric acid; then dilute the saturated solution with 20 to 30 parts of water and put in an amalgam of eight parts mercury and one part silver leaf, upon which after some days crystals are formed. The crystals consist of an amalgam of silver, or rather a definite compound of the silver and mercury. The name is formed from the supposed connection between the moon and the metal silver.

DIANIUM, ancient name of Denia, Spain (q.v.).

DIANO MARINA, dē-ä'nō mä-rē'na, Italy, winter resort in the province of Porto Maurizio, on the Ligurian Sea, 20 miles east of San Remo, and adjoining the Riviera. It suffered greatly from an earthquake in 1887. There is a large trade in olive oil. Pop. 1,929.

DIANORA, a character in the fifth story of the 10th day of the 'Decameron' of Boccaccio. Chaucer's 'Franklyn's Tale' is founded on this story.

DIANTHUS, a genus of the pink family (*Caryophyllaceæ*). The genus has about 200 species, natives of the Old World. The name is said to be from the Greek and to signify "Jove's flower." The American species are all naturalized from Europe, and are fugitives from cultivation. The best known are maiden pink (*D. deltoides*), which in summer is found in the region from eastern Massachusetts to Michigan, and the bunch-pink or sweet-william (*D. barbatus*), found wild occasionally in the Eastern and Middle States.

DIAPASON, dī-ą-pā'zŏn (meaning complete, all-pervading), a term in music by which the ancient Greeks designated the octave. The French use the term for tuning fork and as equivalent to pitch. Diapason is also the English name given to the fundamental sonorous, noble-toned stops of the organ.

DIAPEDESIS, dī-ą-pę-dē'sĭs, a process in which red and white blood cells pass through the walls of the capillary blood vessels. It is a constant accompaniment of inflammation, and is to be regarded as a protective mechanism on the part of the body, particularly of the white blood cells.

DIAPER, textile fabric used for towels and napkins, and formed either of linen or cotton, or a mixture of the two, upon the surface of which a figured pattern is produced by a particular method of twilling. In the fine arts the term is used for a surface decoration consisting of a repetition of a surface unit or units of design evenly spaced.

DIAPER ORNAMENT, in architecture, an ornamentation of flowers, or variegated figures, applied to a plain surface, either carved or painted. If carved, the flowers are entirely sunk into the work below the general surface. They are usually square, and placed close to each other, and are various in their pattern and design. The name is supposed to be derived from jasper with reference to the decorative effect of veining.

DIAPHANOSCOPE, an apparatus used to exhibit transparent pictures or photographs. It has an adjustable lens so that the picture may be exhibited at the same distance from the eye as the focal lens with which the picture was first taken. Ordinarily a glass positive of the picture is used.

DIAPHORETICS, or **SUDORIFICS,** agencies that increase the secretion of sweat. The chief diaphoretics are water, heat — in the form of hot packs, warm drinks, etc.— alcohol, ipecac, pilocarpine, opium, sweet spirits of nitre, salicylates, etc. Diaphoretics are employed largely to reduce temperature, as they increase the perspiration and thus permit of a large amount of surface evaporation. They are also

useful agents often in the treatment of disease of the skin, since they cause an increased amount of blood to flow to the skin and thus improve its nutrition. Sweating is used to eliminate water in dropsy, and to relieve the kidneys from part of their excretory function when they are diseased. Sweating helps to reduce obesity, as the surplus fat is consumed to form water. In the case of chills and colds diaphoretics relieve internal congestion. See PERSPIRATION.

DIAPHRAGM, dī'ą-frăm. (1) *In anatomy*, a dome-shaped muscular partition found in the mammals, separating the abdominal cavity from the pleural cavities containing the lungs. It is attached to the lower end of the sternum, the ninth, tenth, eleventh and twelfth ribs, and the upper three or four lumbar vertebræ. Its general structure is that of a system of muscular fibres radiating from a central tendinous portion. It is pierced by the inferior vena cava, the œsophagus, the aorta, the thoracic duct, the greater splanchnic nerve, the azygos and hemiazygos veins and the sympathetic trunks. The diaphragm is lined above by pleura, below by peritoneum, and on its lower surface are supposed to be the stomata by which the lymphatic system opens into the peritoneal cavity, although the existence of these openings is still a matter of dispute. It is innervated by the third, fourth and sometimes the fifth cervical nerves and by the phrenic nerves, which originate from the cervical plexus. It receives blood from the interior phrenic arteries below and behind, the diaphragmatic arteries above and behind, and the superior phrenic, musculo-phrenic, and superior epigastric arteries in front. Its venous circulation is carried on by the inferior phrenic vein. The diaphragm originates from the cervical myotomes of the embryo. In the course of development it undergoes the same displacement backwards that characterizes the heart and lungs. This is shown in the adult by the cervical innervation of the diaphragm.

In breathing, the diaphragm causes inspiration by contracting, thus decreasing its upward curvature and enlarging the chest cavity. In expiration it is relaxed. It is the principal respiratory muscle. See RESPIRATION.

(2) *In optics*, an annular disc in a camera or telescope or other optical instrument, to exclude some of the marginal rays of a beam of light. The original form of this beautiful contrivance is the iris of the eye, which shuts out strong light and regulates the quantity admitted.

DIARBEKIR, dē-ār"bĕ-kēr', Asiatic Turkey, city, capital of the vilayet of Diarbekir. It stands on a high bank overlooking the Tigris, and is surrounded by a lofty massive wall, built of blocks of black porous stone, the best houses being also of the same material. The principal edifices are the great mosque, a fine structure with a square tower, and originally a Christian church; and the Armenian cathedral and Chaldæan church, handsome buildings recently erected. The manufactures, once very extensive but now greatly decayed, consist chiefly of iron and copper ware, leather, silk, woolen and cotton goods; the bazaars are well stocked with goods of every description and a limited trade is carried on with Syria and Aleppo. It is the seat of the patriarch of the Syrian Jacobites. Pop. about 38,000.

DIARRHŒA, a symptom of a disordered condition of the intestines, accompanied by too frequent movements of the bowels, due to their increased peristaltic (or wave-like) motion. Like dyspepsia, it is only a symptom of some pathological condition. Diarrhœa is usually the result of some indiscretion in diet, such as the eating of unripe or overripe fruit, improper or indigestible foodstuffs; or of poorly cooked, decomposed or tainted meats and fish, these inducing a kind of diarrhœa due to toxic substances, and frequently alluded to as ptomaine poisoning. While relatively more prevalent in the city than in country districts, and oftener found among the poor than the well-to-do, it cannot be said that diarrhœa is particularly a disease of the city or of the poor, since severe and even fatal attacks of it frequently occur among the rich inhabiting the seaside or mountains.

The conditions that produce diarrhœa are varied and numerous. Exposure and sudden chilling of an overheated body, particularly of the abdomen, are potent causes; and travelers who make frequent changes of drinking water are very susceptible to it. In these cases personal idiosyncrasy plays an important rôle. The drinking of impure water and living in poor hygienic surroundings cause diarrhœa. Whether sewer gas or pollution of the atmosphere has direct influence is a disputed point, but it is certain that direct drainage of polluted sewage from districts infected with epidemic diarrhœa into a water supply is a potent cause.

Daily variations of temperature, such as are experienced in the hot season from May to September, are familiar predisposing factors. Environment such as is found in densely populated districts where people live in damp basements, etc., with vitiated atmosphere and want of care, is in the same category of causes.

Diarrhœa is often caused by the irritating action of mineral poisons, such as mercury, arsenic and antimony, by overdoses of croton oil, etc., or by various cathartic nostrums. Worms of various species are likewise causative factors. Of late much attention has been given to these parasitic causes, notably that of protozoön *Amœba coli*, so frequently found in the stool of diarrhœics, principally in tropical cases. Secondary diarrhœa is a phenomenon found during an attack of some antedating disease, as ulcer of the bowel, cancerous growths of the intestines and the inflamed and ulcerative stage of typhoid fever. In diabetes and Bright's disease it is mostly a form of eliminative diarrhœa. In neurotic subjects psychogenic diarrhœas are frequent and are often very troublesome. Nearly 25 per cent of the chronic diarrhœas are of psychogenic origin. They represent unconscious wishes. These psychogenic diarrhœas are characterized by the frequency of partly formed movements although this is not absolute.

The symptoms of diarrhœa naturally vary with the causes, though certain symptoms are common to all forms. One of these is the frequency and character of the stools, which may vary from 5 to 20 or more in a day. At first soft, and mixed with particles of undigested food, they gradually grow more liquid until almost watery, and are attended by griping colic-like pains about the navel. Flatulence and vomiting are also prominent features, and thirst is

often great, owing to loss of liquids from the body through repeated evacuations. The pulse is usually quickened, though the fever is seldom high, and is of no serious consequence. If the diarrhœa become chronic or long continued, prostration ensues, though this contingency is infrequent. Secondary diarrhœa, due to chronic congestion or pathological changes in the intestines, is much more intractable.

The treatment of diarrhœa must necessarily vary with the inciting cause, though many cases recover spontaneously or need treatment for only a few days. Absolute rest and low diet are indicated in the toxic forms. If the attack is due to exposure or cold, the application of hot turpentine stupes to the abdomen, with the administration of small and frequent doses of opium and bismuth, may be all that is required; when, however, it is due to offending food in the intestines, or to ptomaines, the prompt removal of these elements must be effected. Broken doses (one-tenth grain) of calomel every half hour, or a teaspoonful dose of Epsom salts in Vichy water, until the stools assume a more natural consistency, are prompt and efficient remedies. By far the most popular is a prepared dose of castor oil containing 10 to 15 drops of laudanum. This should be followed by astringent antiseptics, combined with opium and a digestive; for instance, sulphocarbolate of zinc or soda, opium in either powdered or extract form, with blue-mass. Should the pain be excessive, chlorodyne, or hyoscyamine, or in extreme cases small doses of morphia may be given until the patient is relieved. For the vomiting, small doses of hot water or plain lime water will be effective, and the application of the old-time spice-plaster or hot poultice will be found soothing. Some prefer the ice-bag. Should there be any oppression, aromatic spirits of ammonia, or stimulants like brandy or whisky, well diluted, will restore the strength, though this is seldom necessary.

The undue haste to stop diarrhœa suddenly, and the eagerness which patients exhibit to take large doses of paregoric or laudanum, or nostrums called cholera drops or diarrhœa mixtures, in all cases are mentioned only to be condemned. A more rational course is to remove the cause, thereby assisting nature to regain her normal tone and reassert her disturbed functions.

In children and infants the same general rules should be followed, with modifications to suit each individual. In place of milk, substitute a milder form of nourishment such as egg, barley or rice water. (See CHOLERA INFANTUM). Another and more direct form of treatment than giving remedies by the mouth is the use of enemas, or both can be employed in conjunction. High rectal enemas are used of astringent antiseptics held in suspension in thin starch solutions, or with turpentine added.

The constipation which usually occurs after recovery from diarrhœa had better be disregarded for a day or two, when mild cathartics or laxative remedies can be used. Very effective remedies are glycerine suppositories and enemas of cold water.

DIARY, a daily record of events or observations made by an individual. It contains a narrative, more or less detailed, of matters of personal interest, often including the results of reading or meditation. Yet references to current events of general interest are sometimes introduced. This form of diary is also known as a journal. Books convenient for making such records are issued every year, containing besides the blank pages various reference tables, etc. The "Ephemeris" of the ancients was originally a military record or journal, a daybook or account-book, also a collection of tables showing the position of the heavenly bodies, but passed into literature to mean a collection of records of what has happened on the same day in various years, or a mere general name for any form of periodical books or magazines.

Diaries have often furnished the historian with invaluable material, supplying the absence of public records and furnishing minute and intimate details of manners and of motives that do far more to help us to understand the past than more formal records. Such documents as Robert Baillie's 'Journals,' the 'Diaries' of Pepys and Evelyn, and the 'Journals' of Greville are among the most valuable sources of real history.

DIAS, dē'ăs, **Antonio Gonçalvez**, Brazilian poet: b. Caxias, state (then province) of Maranhão, 18 Aug. 1823; d. 3 Nov. 1864. He was educated at the University of Coimbra, Portugal, and returning to his native country, entered the practice of law in Maranhão. He published at Rio de Janeiro in 1846 a volume of poems entitled 'Primeiros cantos,' which was followed by his drama of 'Leonor de Mendonça' (1847); 'Segundos cantos' (1848); and 'Ultimos cantos' (1850). In 1848 he was chosen professor of national history in the College of Dom Pedro II; he was subsequently employed in the office of the Minister of Foreign Affairs, and in 1855 was charged with a scientific mission to Europe. His poetry has been exceedingly popular in Brazil. His works also include a report, 'Brazil e Oceania'; and several papers of importance on the migrations of the South American Indian tribes in the collection of the Instituto Geográfico é Histórico of Rio de Janeiro.

DIAS, Henrique, Brazilian general: b. Pernambuco about 1600; d. latter part of the 17th century. He was a freed negro, who by his superior attainments rose in 1639 to the supreme command of the colored soldiery of the Brazilian army. He took a conspicuous part in the protracted warfare which finally led to the overthrow of Dutch influence. The government failed to reward his services and he died in great poverty and neglect.

DIAS DE NOVAES, Bartholomeu, Portuguese navigator: d. 1500. In 1486 he was commissioned by John II of Portugal to continue the exploration of the African littoral. He advanced along the Atlantic coast of the continent to within two degrees to the south of the Tropic of Capricorn, and 120 leagues further south than any point previously explored. Thereafter he sailed southward on the open sea and doubled without knowing it the meridional point of the continent and reached land about 40 leagues to the eastward. After reaching Rio de Infante (Fish River) he turned back, sailing along the coast. It was then he discovered the terminal point of Africa, which he named Cabo Tormentoso, or Cape of Tempests. The king later changed the name to Cabo de Buena Esperanza or Cape of Good Hope. In

December 1487 Dias reached Lisbon and was received with great acclaim. Ten years later, however, he saw Vasco da Gama chosen in his stead to lead the exploring expedition of 1497. He accompanied the latter to India and in 1500 went to Brazil with Pedro Alvarez Cabral, but perished in a storm on his return from this expedition.

DIASPORA. This was the name given to the Jewish emigrants in the time of the Apostles. The Jews were scattered abroad over the face of the earth. The Roman Empire had in many of its cities these Jewish colonies. In the lands east of the empire they found their way. Some remains discovered a few years ago seem to indicate their presence in far-off China. This widespread movement was due in some quarters to forcible deportation by conquering peoples, as in the Euphrates Valley. Other groups went forth after the failure of the Maccabean patriots to perpetuate their kingdom. Others no doubt left their native land for commercial reasons. Usually they had their own community organization, which sometimes became very powerful, as it did for instance in Alexandria. The organization was commercial as well as religious. The centre of the community was the synagogue. Everywhere Jerusalem was the centre of the national worship. To its priests and temples tithes were paid by devout Jewish worshippers, sending them from all parts of the world.

DIASPORE (Gr. "scattering"), a native hydrated oxide of aluminum, having the formula $Al_2O_3.H_2O$, and crystallizing in the orthorhombic system. It is commonly gray, creamy-white or lilac in color, though sometimes various shades of brown and yellow or colorless. It has a hardness of from 6.5 to 7 and a specific gravity of about 3.4. It is transparent to subtranslucent and exhibits powerful doubly refracting properties. The best-known localities in which it occurs are Chester, Mass., Newlin, Pa., in the United States and in Europe near Schemnitz, Hungary. Many specimens decrepitate strongly when heated before the blowpipe, separating into pearly scales that are scattered in all directions; and it is from this peculiarity that the mineral derives its name.

DIASTASE, dī'ą-stās, or **AMYLASE,** a substance belonging to the group of enzymes and believed to be itself a mixture of several simple enzymes. It is found in barley, oats and other plants and also in animal tissues. When in solution it possesses the property of causing starch to break up at the temperature of 156° F., transforming it first into dextrin and then into maltose. It is obtained by digesting in a mixture of three parts of water and one of alcohol, at a temperature of 113° F., a certain quantity of germinated barley ground and dried in the open air, and then putting the whole under pressure and filtering out the liquid. Such extracts evaporated at a low temperature in a vacuum to a thick syrupy condition are known in commerce as "malt extracts." Diastase is solid, white and soluble in water and diluted alcohol, but insoluble in strong alcohol. If 200 parts of fecula be mixed with 1,000 parts of water and a portion of diastase be added and the mixture kept at a temperature of about 156° F., the starch is converted gradually into dextrin and then into grape sugar. The action of the diastase is threefold, liquefaction of the starch, hydrolizing it into dextrin and then hydrolizing the dextrin into maltose. This triple function is regarded as proving the composite nature of the diastase. The action of diastase is prevented by acids, alkalis and some salts, but not by alcohol or ether. A solution of diastase becomes acid and loses its power on starch. The action of the diastase of germinating barley is important in brewing, distilling and in the baking industry. The composition of diastase has not been exactly determined. It is, however, an albuminoid substance. A body having the power of converting starch into sugar exists in saliva and is known as ptyalin. It is also an albuminoid and is probably analogous to diastase in its composition. Diastase is used in the manufacture of dextrin (q.v.). As malt extract it has a limited use in laundries for removing starch from stiffened fabrics before they are laundered.

DIASTOLE, dī-ăs'tō-lē. In the description of circulation of the blood it was shown that Harvey first appreciated that there was a successive contraction and dilatation of the heart-muscle. The term systole has been applied to this contracted state and the term diastole to the succeeding dilatation.

DIASTROPHISM, one of the great processes of dynamical geology, including all movements of the earth's crust produced by internal forces. See section on *Diastrophism* in the article on GEOLOGY. See also MOUNTAINS and CONTINENT.

DIATHERMANCY, a term designating the property that is possessed in various degrees by different substances of transmitting radiant heat. Bodies that are equally transparent, that is, bodies which have equal power of transmitting rays of light, are very different in their power of transmitting heat rays. Thus a thin plate of glass and a thin plate of rock salt may be nearly equally transparent, but the plate of rock salt has far superior power of transmitting rays of heat. This may be shown very simply. Let a delicate thermometer be placed near a lamp (but not above it); the mercury will rise on account of the heat radiated to it. If a plate of rock-salt be interposed between the lamp and thermometer, the mercury will fall slightly; but if a plate of glass of equal thickness with the plate of rock-salt be interposed, it will be seen that the greater part of the heat is at once cut off from the thermometer. The transparency of bodies to light does not at all necessitate their diathermancy. Thus clear rock-crystal, which is transparent, and smoky rock-crystal, which is opaque, are nearly equally diathermanous; and solution of iodine in bisulphide of carbon, which is perfectly opaque to light, is highly diathermanous. The diathermancy of plates of various thickness has also been determined. The diathermancy decreases very rapidly as the thickness increases. Consult Stewart, 'Treatise on Heat'; Deschanel, 'Elementary Treatise on Natural Philosophy.' (See also RADIATION; THERMO-ELECTRICITY). Consult Tyndall, 'Heat as a Mode of Motion' (6th ed., London 1880).

DIATHESIS, *in medicine,* a term applied to the predisposition of the body which renders

it prone to certain diseases. The term is particularly applied to inherited or congenital predispositions which may, however, only become observable at a late period in life. While certain sets of reactions are recognized as being typical of human bodily processes in general, it must not be overlooked that each individual has peculiarities of composition and structure. Thus, there may be a constitutional lack of resisting power to the entrance of the tubercle bacillus. This condition is known as tuberculous diathesis. The chief types of diathesis are: bilious, or one in which there is imperfect elimination of bile as a chronic condition; calculous, a constitutional tendency to the formation of calculi or stones; cancerous, the imperfectly understood condition where cancers are liable to form; nervous or psychopathic, an extreme sensibility of the nervous system, generally accompanied by a tendency to derangement; gouty, lithic, rheumatic, or uric-acid diathesis, a constitutional tendency to the accumulation of uric acid and urates in the body fluids and consequent liability to gout, rheumatism, etc. The recognition of a diathesis is often important in connection with the treatment to be adopted for any morbid state. The tendency to some diseases may also be defeated by the adoption of a habit of life unfavorable to its development.

DIATOMACEOUS EARTH, and **DIATOMACEOUS OOZE.** See DIATOMS.

DIATOMS, a sub-order of microscopic plants belonging to the class *Algæ*. A plant of this sub-order consists of a unilocular or a septate cell; and its cells are composed of two symmetrical valves, multiplying by spontaneous separation. There are two well-defined sections: (1) *Diatomeæ*, including species invested with a silicious epidermal covering occurring both in fresh and salt water, often exhibiting exquisite sculpturings when seen under the miscroscope and testing the highest powers of the instrument; (2) *Desmidieæ*, minute freshwater plants of a green color, without a silicious covering. There are more than 4,000 distinct species scattered over all parts of the world. The walls of the cells are rendered hard by silica and they are reproduced by fission, the splitting taking place parallel to the longer axis. When the protoplasm escapes the cell walls retain their shapes and delicate markings. Enormous quantities of them are found as fossils in the beds of the Tertiary formation. Often the protoplasm of two diatoms will escape and unite to form a zygospore, which after a time will divide into two, each forming a new cell larger than before. Some diatoms are free and move rapidly through the water; others secrete a mucilaginous substance whereby they attach themselves to various objects. In some cases the diatoms, after splitting, remain attached to one another, forming bands or ribbons. They are classified, according to the structure of the cell walls, three main families being recognized, according as they have on the principal face of the wall a distinct ridge (*Raphidieæ*), an indistinct or false ridge (*Pseudoraphidieæ*), or no ridge at all (*Araphidieæ* or *Cryptoraphidieæ*.

The diatoms possessing a silicious epidermis have been eagerly studied of late years by microscopical observers, who have greatly increased the number of genera and species. They are universally distributed and their silicious coverings being indestructible, their remains are accumulated and perpetuated in many localities, sometimes forming extensive deposits, as of Richmond, Va., which is said to be built upon a stratum of these miscroscopically minute atoms 18 feet in thickness. Species of *Arachnoidiscus* and other genera of great beauty are obtained from guano. The bergmehl or mountain-meal of Sweden consists of diatoms. The mud at the mouths of many rivers, the sediment of ponds, ditches and even rain-troughs, contain myriads of the same minute organisms. They were found by the Arctic navigators investing the fields of polar ice; and they have also been detected in the dust evolved from volcanoes.

Their remains are found in rocks of many geologic ages, but are especially abundant in the Miocene beds of California. These organisms are believed to have yielded the organic matter necessary for the formation of the rich petroleum deposits of that state. Diatoms are the source of the diatomaceous earth used in scouring soaps and polishing powders. Diatomaceous oozes are now accumulating on the ocean bottom. See OOZE.

DIATONIC, in modern music the term applied to compositions which follow the tones, intervals, or harmonies of the standard major or minor scales, without chromatic alteration. Originally from the Greek, meaning "through the tones," the diatonic mode of the ancient Greeks — as distinguished from their chromatic and enharmonic mode — formed the foundation of their whole system of music, and was arranged in three tetrachords composed of one semitone and two whole notes.

DIATRIBE, (Gr. *diatribé*), (a dwelling or lingering upon) originally signified a sustained discourse or disputation, afterward came to be applied to a violent and sweeping criticism, whether written or spoken.

DIAULOS. See OLYMPIC GAMES.

DIAZ, *dēth*, **Don Juan Martin,** (EL EMPECINADO), Spanish patriot: b. Castrillo de Duero, Valladolid, 1775; d. 1825. He entered the army in 1792 and during the Peninsular War, at the head of 6,000 men, he successfully harried the French. In 1814 he was made colonel in the regular army and was later made field marshal by the king. In 1815 he petitioned Ferdinand VII to reinstitute the Cortes and for this he was thrown into prison and later banished to Valladolid. He joined the Constitutionalists in the insurrection of 1820, and in the short and unequal struggle he showed his former great courage. In 1823 he was captured, and after the restoration of Ferdinand, Diaz was exposed in an iron cage, imprisoned in a loathsome dungeon for two years and then sentenced to death by hanging. He was stabbed to death when he resisted the executioners. The nickname, El Empecinado, "the one covered with pitch," is that given by the peasants to the natives of Castrillo, from the fact that two rivers there form a black mud called *pecina*.

DIAZ, Miguel, Spanish explorer: b. Aragon second half of the 15th century; d. 1514. He took part in the second voyage of Columbus, and was one of the colonists of the island of Santo Domingo. He quitted the colony in 1495

in consequence of a duel, and took refuge with a few of his companions in the southern part of the island, where he married a native. Through the advice of his wife he discovered the gold mines in this part of the island, the existence of which he communicated to Bartolomé Columbus, whereby he reconciled himself with the colonists, and led the way to the foundation of the town of Nueva Isabella, afterward called Santo Domingo. He was made governor of Porto Rico in 1509, but his fidelity to the family of Columbus repeatedly brought him into trouble.

DIAZ, Porfirio, dē'ăs, Mexican statesman: b. Oaxaca, 15 Sept. 1830; d. 2 July 1915. He received a classical education at the Oaxaca Institute, and had begun studying law when the war with the United States broke out. He served through that struggle in the National Guard, and on the conclusion of peace made a study of military science. On Santa Anna's accession to the dictatorship, he left the army and practised law; but returned and bore a conspicuous part in the revolution of 1854. Subsequently Diaz joined the Liberals then under the leadership and control of Benito Juarez, and as a member of this party he won a seat in Congress in 1861. He took the field to oppose the French troops and was taken prisoner, but made his escape; harassed Maximilian's troops till forced to surrender a second time at Oaxaca in 1865; besieged and captured Pueblo in 1867, and immediately marched on Mexico City, which surrendered to him 21 June. On the re-establishment of the republic he was an unsuccessful candidate for president. In 1872 and 1876 he led revolutions against the government and after three severe battles occupied the capital in the latter year. In 1877 he was elected president to fill the unexpired term of the fugitive president, Lerdo. His energetic and businesslike administration at once gained favor with and inspired confidence in foreign investors, and foreign capital soon began to flow into the country which entered upon a new era of development and prosperity. According to the "plan of Tuxtepec," which he had proclaimed, he was ineligible to succeed himself. His secretary, General Gonzales, was elected president and General Diaz was appointed chief-justice of the Supreme Court, and elected governor of Oaxaca. The new administration soon betrayed signs of weakness and it became ever more and more evident that if peace and prosperity were to endure Diaz must be again placed at the head of the government and so in 1884 he was re-elected president; in 1886 his partisans secured the abolition of the law prohibiting a second consecutive presidential term. As each presidential term expired the constitutional provisions for the election of chief magistrate of the nation were gone through, but it was evident to all that partisans of Diaz manipulated the returns. However, no real opponent appeared, at least no strong leader, until 1911, when Francesco Madero opposed what he called the dictatorship of Diaz. He was successful and in May 1911, Diaz resigned and departed to Spain. To Diaz Mexico is indebted for her rise, progress and standing as a nation.

DIAZ, Ruy, Spanish soldier: b. Seville, Spain, 1503; d. Peru 1538. He went to Peru in 1532 with the expedition of Diego de Almagro, and took part in the conquest of the province of Cuzco; then joined Velalcazar in the conquest of the province of Quito. He was sent by Pizarro to explore the valley of the Rimac, and it was in accordance with his report that the site was chosen for the city of Los Reyes (now Lima), and the city founded. When war broke out between Almagro and Pizarro, Diaz sustained Almagro, was in the battle of Abancay, 1537, and other important engagements; and was captured at the battle of Salinas, 1538, and put to death.

DIAZ DEL CASTILLO, ką-stē'lyō, **Bernardo** (vulgarly **Bernal**), one of the Spanish conquerors of Mexico, and historian of that conquest: b. Medina del Campo, in Old Castile, about 1498; d. Santiago de los Caballeros, Guatemala, about 1590, leaving numerous descendants. His work, entitled 'Historia Verdadera de la Conquista de la Nueva Espafia,' is of great value and interest. The date of his death is not known. Probably his family belonged to the minor nobility: he says, when speaking of the conquerors, "We were for the most part hidalgos, although some were not of such clear lineage as others"; but he lacked the influence necessary to secure his appointment as an officer. He speaks of himself as "having been in this country (Central America and Mexico) twice before the coming of Cortés, and the third time with him." On the first occasion he accompanied Pedrarias Davila (q.v.); on the second, he took part in the expeditions to Yucatan and along the coast of Mexico under Córdoba and Grijalva (1517–18). Between 1515 and 1517 he visited Cuba; from Santiago de Cuba, on 18 Nov. 1518, he sailed with the Spanish fleet under Cortés; during the next few years he fought, it is said, in more than 100 of the battles with the Indians preceding or following the capture of the City of Mexico; and in 1523–24 he served under Pedro de Alvarado, conqueror of Guatemala and Salvador. Alvarado established the seat of government in the native (Guatemalan) town of Almolonga, afterward called Santiago de los Caballeros; and Bernal Diaz was made governor of this town, as a reward for his service in the field. He writes naïvely: "I was held in no inconsiderable degree of estimation in my day as a soldier"; and again, "I was twice in the hands of the enemy who were carrying me off to sacrifice, but God gave me strength to escape out of their clutches." In 1550 he was summoned to an important council at Valladolid, "as being the most ancient of the conquerors of New Spain." His history was finished 26 Feb. 1568. Two licentiates who examined the work at that time, "observed that in regard to my style or language it was conformable to that in ordinary use in Old Castile, and that as such it was the more agreeable, not being embarrassed with flowering affected phrases." The particular merit of the history is that it gives to each of the officers and soldiers the credit which was his due, instead of ascribing the overthrow of the Aztec empire and the establishment of New Spain solely to the genius of Cortés. "The historians Gomara and Illescas," Diaz writes, "never chose to relate our heroic actions, leaving all our value and honors in the dark, where they would have remained were it

not for this my true history and assigning such great merit to Cortés. Although they were right to a certain degree (in praising our leader), yet they should not have forgotten us.» So desirous is he to make known the exact truth, that at the end of his manuscript he writes, «I beg the printers (señores impresores) for mercy's sake not to omit anything from or add anything to the foregoing.» The original manuscript has always been kept in Guatemala, first by the author and his descendants and later by the municipality of the capital. Many editions appeared from 1632 to 1877, the chief being that in 3 volumes at Madrid in 1632, the English versions of Maurice Keatinge (1800) and John Ingram Lockhart (1844), the German editions by Ph. J. von Rehfues in 1838 and by Karl Ritter in 1848. Two French versions appeared in 1877, one by D. Jourdanet, the other by José María de Heredia. In 1878 appeared two Hungarian editions, by Károly Brózik, and by Moses Gaal. All these editions and translations failed to do full justice to the original and caused many adverse opinions in regard to the 'Historia Verdadera.' This was remedied, however, in 1904 when the first critical edition of the work was issued in Mexico by Genaro García. Alfred Percival Maudslay published an English translation of this edition, with introduction and notes, under the auspices of the Hakluyt Society (3 vols., London 1908). By means of these publications the work takes its proper place as one of the greatest historical records by an eyewitness of the early conquest and settlement of New Spain.

DIAZ DE LA PENA, pē'ñä, **Narcisse Virgile,** French painter: b. Bordeaux, 20 Aug. 1807; d. Mentone, France, 18 Nov. 1876. He was of Spanish parentage, was left an orphan at the age of 10, was educated by a clergyman at Bellevue, where a snake-bite occasioned the amputation of a leg. At the age of 15 he was apprenticed to a porcelain painter, but ambitious of working in oils, about 1813 began to exhibit in the Salon. He in time won fame by his landscapes, which he peopled with nymphs, loves and satyrs. These figures are badly drawn, but as a colorist Diaz ranks highly among the painters of the romantic school in France, and to color he was content frankly to sacrifice form. He was also an exquisite painter of flower-pieces. He received the cross of the Legion of Honor in 1851. His pictures sold well and he amassed a large fortune, which he expended in great hospitality at his Paris studio. His principal works are 'The Fairy with Pearls'; 'Venus and Adonis'; 'Foolish Girls'; 'Descent of the Gypsies'; 'Sous Bois.' The Metropolitan Museum, New York has several of his pictures. He is also represented in Baltimore and Chicago. Consult Muther, 'History of Modern Painting' (London 1907); Hustin, 'Les artistes célèbres'; and Van Dyke, 'Modern French Masters' (New York 1896).

DIAZ DE PINEDA, pē-ñā'-dä, Spanish soldier: b. Torrelavega about 1500; d. Peru 1545. He went to Peru with Francisco Pizarro in 1531; explored the river Magdalena in 1535; and in 1539 became governor of the province of Quito. In 1540 he joined the expedition of Gonzalo Pizarro for the conquest of the Canelos and the exploration of the country east of the Andes. He was sent in search of the party of Orellana, who had gone ahead to seek for supplies. In the course of the search, which was unsuccessful, Diaz explored a large part of the course of the Amazon, but returned to the main expedition, which by his aid succeeded in returning to Peru, though with heavy losses. When Gonzalo Pizarro revolted against the viceroy, Nuñez, Diaz at first offered his services to the viceroy, but later joined Pizarro. He was surprised and defeated by Nuñez, but escaped capture.

DIAZ DE SOLIS, Juan. See SOLIS, JUAN DIAZ DE.

DIAZEUCTIC TONE, the name given to the tone interval separating the disjunct and the middle tetrachords in the Dorian scale of ancient Greek music.

DIAZO-COMPOUNDS resemble Azo-Compounds (see COAL-TAR COLORS), in containing the group —N_2—, but with the difference that in the former two organic radicals are united to the characteristic group, as $R.N_2.R$, instead of one as in the latter.

These compounds were discovered in 1858 by Griess, who obtained them by treating aromatic amino-compounds with nitrous acid at low temperatures. (See AMINE). Following up his discovery he experimented with them in reaction with many substances, among these the amido-compounds, from which combinations were developed a series of brilliant direct dyes for animal fibres. The present economic value of the diazo-compounds lies in their availability as intermediates in the manufacture of dyestuffs, and in this function they are not usually separated from the solutions in which they are formed, but are promptly converted into the dyes by a further operation.

When isolated they are colorless crystals, which dissolve readily in water, sparingly in alcohol, and not at all in ether. They are in general unstable, and when dry are explosive.

They are prepared by dissolving a molecular part of the chosen amine in water with from two to three parts of hydrochloric acid, and then adding slowly, while stirring a solution of one molecular part of sodium nitrate, keeping the apparatus cold—at 35° to 40° F. When the mixture shows a slight excess of nitrous acid, the diazotisation is complete. This solution is then added to a solution of one molecular part of some amine or phenol, stirring constantly. The dye thus formed in some cases precipitates, in others it has to be separated out by the addition of sodium chloride or hydrochloric acid. The benzenoid and naphthalenoid amines are those most commonly diazotised on a large scale for commercial uses. Diazo-compounds are also produced in a dry or paste form for the use of dyers in the production of the so-called «ingrain» azo-colors, which are developed directly on the textile fibres. Consult Beacall, T., 'Dyestuffs and Coal Tar Products' (London 1915); Cain, J. C., 'The Chemistry of the Diazo-Compounds' (London 1908); Sidgwick, N. V., 'The Organic Chemistry of Nitrogen' (Oxford 1910).

DIBBS, the English name of a simple game dating from remote antiquity. It consists in throwing up the joint bones of the legs of sheep and catching them as they descend first

on the palm and next on the back of the hand. The game is common enough throughout Europe and was known in ancient Greece as is proved by figures on Grecian vases depicted as engaged in the sport. In Scotland small stones are substituted for the bones and the game is popularly known as "chucks" or "chuckie stanes."

DIBDIN, Charles, English lyric and dramatic poet and actor: b. Southampton, March 1745; d. London, 25 July 1814. He opened a little playhouse in London, the Sans Souci Theatre, and there brought out his own plays, enlivened with his own songs, set to music of his own composition, and with himself as the leading actor. He wrote probably 50 plays and operettas (best remembered among them 'The Quaker,' an operetta), two novels, a 'History of the Stage,' and over a thousand songs. His 'Sea Songs,' such as 'Tom Bowling,' and 'The Flowing Can,' are popular favorites still. He wrote an autobiography 'Professional Life' (1803).

DIBDIN, John Thomas, English song writer and dramatist: b. London, 21 March 1771; d. there, 16 Sept. 1841. He was the second son of Charles Dibdin (q.v.) and in 1775, when only in his fourth year, was brought upon the stage as the Cupid of Shakespeare's 'Jubilee,' while Mrs. Siddons personated Venus. After being connected with various theatres, and writing great numbers of songs, he returned to London in 1795, wrote a number of dramas with great success for the minor theatres, and obtained an engagement at Covent Garden, with which he continued connected for 14 years. Among his numerous pieces the best known are 'Mother Goose,' by which the theatres are said to have netted a profit of $100,000; the 'High-mettled Racer,' which was almost equally profitable; 'The Cabinet'; 'The Jew and the Doctor'; and 'Past 10 O'clock,' which long held the stage. He wrote a 'Metrical History of England' (1813); and 'Reminiscences' (1827).

DIBDIN, Thomas Frognal, English bibliographer, son of the elder brother of Charles Dibdin (q.v.): b. Calcutta 1776; d. Kensington, 18 Nov. 1847. He became a popular preacher in London, and was well known there as a bibliomaniac. He proposed a club to dine together in honor of bibliography, which was established in 1812, under the name of the Roxburghe Club. This club adopted a rule that each member should every year reprint a book for presentation to all the members. Of his numerous writings those connected with bibliography are alone of any value. Among them may be noted 'Bibliomania' (1809); Bibliograpical Decameron' (1817); 'Typographical Antiquities of Great Britain' (1810–19).

DIBON, the name of two cities mentioned in the Bible. 1. A city of Judah, five miles north of Arad, mentioned in Neh. xi, 25. At present it is known as Dhaib. 2. A city of Moab, five miles north of Arnon, built by the Gadites. It is referred to in Num. xxxii, 34, ib. xxxiii, 45 and ib. xxi, 30. The modern city is called Dhiban. For its historical connections consult Böhl 'Kananäer und Hebräer' (1911); Schmidt, 'Messages of the Poets' (1911) and 'Songs of the Conquest' (in *Journal of Biblical Literature*, 1914).

DIBRA, Serbia, a city near the Albanian frontier, three miles from the confluence of the Black Drin and the Radika. It is an important agricultural centre. It is fortified and was formerly the capital of the Sanjak of Dibra in the Vilayet of Monastir during the Turkish régime. It was taken by the Serbians in the Balkan Wars of 1912–13 and its possession confirmed by the treaty of peace arranged in 1913. The population, mostly Albanians, with colonies of Bulgarians and Serbians, numbers about 16,000.

DIBUTADES, dī-bū'ta-dēz, Greek sculptor or potter of Sicyon; lived about 600 B.C. Although he is the reputed originator of work in relief, the only historical basis for his fame is a Corinthian work, bearing his name, supposed to date from before 600 B.C.

DICÆARCHUS, Greek philosopher: b. Messina, Sicily. He was a contemporary of Aristotle and lived mostly in Greece and in the Peloponnesus. He wrote several works on geography, history, philosophy and politics. Perhaps his greatest work was his 'Life of Hellas,' in three books, an account of the geography of Greece, its political development, its public and private life, manners and popular customs. Only fragments of it have come down to us. Cicero's 'Republic' is supposed to be based on a work of Dicæarchus. Many works long attributed to this author are now known to be from other hands, of these the 'Cities of Greece' was the chief. Consult Christ, 'Geschichte der griechischen Litteratur' (Vol. II, 5th ed., Munich 1913), and Pauly-Wissowa 'Real Encyclopädie der klassischen Altertumswissenschaft' (Vol. V., Stuttgart 1905).

DICÆUM, genus of Australasian and Oriental small birds, of the family *Dicæidæ* and akin to the sunbirds. They are brilliantly colored, feed on insects and have melodious voices. They build purse-shaped nests of pliable material suspended from bushes. They are often called flower or honey peckers.

DICAST, a member of the popular courts of Athens. To Solon is attributed the institution of these courts. From the citizens over 30 years of age about 6,000 were chosen annually by lot and of this number sections of from 20 to 500 members were chosen daily to hear cases. These dicasts listened to the speeches of the litigants and heard the evidence read; then they voted in secret, being sworn to give their decision in accord with the evidence and the laws. The dicasts were sole arbiters alike in points of law and in points of fact. Consult Lipsius, 'Das attische Recht und Rechtsfahren' (Leipzig 1905–), and Meier and Schömann 'Der attische Process' (Berlin 1887).

DICE (plural of Die), small cubes of bone or ivory, on each of the six sides of which a number, ranging from one to six, is marked permanently. The sum of the two numbers on the opposite sides of a die is always seven; thus if six is at the top one is at the bottom, and so on. One, two, three, or five dice are used, according to the game to be played. They are placed in a cylindrical box about four inches high, and from one and a half to two inches in diameter, open at the top. The box is shaken and turned quickly up so that the dice will fall flat on the table. The aggre-

gate amount of the spots uppermost at each throw are summed up and placed to the score of the thrower. They are used for a number of purposes and various games are played with them. The principal games are "throwing the dice," "round the spot," "centennial," "multiplication," "going to Boston," "draw poker," and "vingt-et-un," all of which will be found described in detail with the rules of each game in A. Howard Cady's 'Dice' (1895). There is no period of history, and no nation, in which some form of dice has not been used. They are depicted on the early Egyptian monuments; those excavated at Thebes can scarcely be distinguished from the dice made to-day, and their use is attested by laws regulating the games played with them in ancient Greece and Rome, as well as in most European countries. The invention of dice is attributed to Palamedes (circa 1,244 B.C.). But the use of cubes with numbered sides for gambling purposes is probably much earlier. The Latin word for dice, *tesseræ*, is derived from the Greek *tesseres*, Ionic for *tessares*, four, because it is on every side square. Numerous passages in the ancient writers, and very many representations in marble or paintings, show how frequent dice-playing was among them. Different from the *tesseræ*, which were precisely like our dice, were the *tali* (which means, originally, the pastern bone of an animal — Greek, *astragalos*). These were almost of a cubic form, and had numbers only on four sides, lengthwise. Three *tesseræ* and four *tali* were often used together, and the game with dice was properly called *alea*, though *alea* afterward came to signify any game at hazard, and *aleator* a gambler.

DICERATHERIUM, an extinct genus of rhinoceroses which inhabited North America during the Oligocene Epoch, distinguished by a pair of horns one above each eye, instead of on the middle line of the head.

DICEY, Albert Venn, English barrister: b. 1835. He was educated at Balliol College, Oxford, was called to the bar in 1863, and from 1882 to 1909 was Vinerian professor of English law at Oxford. In 1890 he was appointed Queen's Counselor. He has published 'The Privy Council' (Arnold prize essay, 1860); 'Treatise on Rules for Selection of Parties' (1870); 'The Law of Domicil' (1879); 'Law of the Constitution' (1885); 'England's Case against Home Rule' (1886); 'Treatise on the Conflict of Laws' (1896); 'Lectures on the Relation between Law and Public Opinion in England during the 19th Century' (1905); 'Introduction to the Study of the Law of the Constitution' (7th ed. 1908).

DICEY, Edward, English journalist and author: b. Leicestershire, England 1832; d. London, 7 July 1910. He was graduated at Trinity College, Cambridge, and was from 1870 to 1889 editor of the *Observer*. He published 'Rome in 1860' (1861); 'Cavour: a Memoir' (1861); 'Six Months in the Federal States' (1863); 'The Schleswig-Holstein War' (1864); 'The Battlefields of 1866' (1866); 'A Month in Russia During the Marriage of the Czarewich' (1867); 'The Morning Land' (1870); 'Victor Emmanuel' (1882); 'England and Egypt' (1884) 'Bulgaria, the Peasant State' (1895); 'The Story of the Khedivate' (1902); 'The Egypt of the Future' (1907).

DICHOGAMY, the condition arising in flowers whose anthers and stigmas do not mature at the same time. See POLLINATION.

DICHOTOMOUS (Gr. "divided into two equal parts"), a term specifically used in botanical description to designate any appearance of branching by forking. Thus the stems of some phanerogams — for example, mistletoe, doumpalm, and many inflorescences — for example, *Caryophylleæ*, begonias — appear forked, while an ordinary fern-frond has no such appearance. The progress of morphological research has, however, shown that true dichotomy — for example, complete division of the growing point into two lateral apices, is really as characteristic of development of the fern-frond as of such obviously dichotomous vegetation as that of *Selaginella;* while conversely the appearance of forking in phanerogams comes about simply by the suppression of the growing point, and the development of two new axes from opposite lateral buds. Outside the cryptogams, (q.v.) indeed, no case of true dichotomy has been described, with the doubtful exception of the roots of cycads (q.v.).

DICHOTOMY in *logic*, a distribution or separation of ideas by pairs; the division of a class into two sub-classes opposed to each other by contradiction, binary classification as revived by Ramus against the Aristotelians; the Platonic doctrine that all classification should be by dichotomy. Since Kant this opinion has found scant favor. In *botany*, a term applied to that kind of branching by a constant furcation or division into two parts, as where the stem of a plant branches into two branchlets, each of which in its turn divides into others, and so on. Example, the mistletoe. The veins of various ferns thus branch dichotomously. In *astronomy*, that phase of the moon where it appears bisected or is only half illuminated, as at the quadratures.

DICHROMATISM. The designation of a phenomenon among birds defined by Chapman as "the existence of two phases of color in the same species." Some writers have included under this term, *albinism*, or lack of pigment; *melanism*, or excess of dark pigment, producing an extensive or complete blackening of the surface (common in mammals, but rare in birds); and *erythrism*, or an excessive reddening of the plumage; but it seems best to learn these outside of the present subject, and also the matter of normal differences in color between male and female and adult and young individuals, for dichromatism implies the two phases existing independently of age, sex, or season" (Beebe, 'The Bird,' N. Y. 1906). The subject has been most thoroughly considered by Leonard Stejneger, but neither he nor any one else has been able to offer an adequate explanation of the condition.

The best known example is our little screech owl (*Scops Asio*), known over almost the whole continent. Most commonly its beautifully mottled plumage is decidedly red or deep reddish-brown in general tone; but many specimens are purely gray. The size, special ornaments, voice and habits of both are alike; but all the early American ornithologists considered them as two separate species, or else as young and old respectively — but some said the red ones were the adults and others the gray. In 1853, however, Dr. J. P. Hoy announced that he had

taken both red and gray young from the same nest; and now it is understood that both varieties often occur in the same brood and in any part of the country, although on the Pacific coast the gray phase predominates. The same tendency to be of two colors exists in several other owls, as the brown owl of Europe, and the California pigmy owl (*Glaucidium*), as mentioned by Coues.

Dichromatism is also displayed by many other kinds of birds, notably those of the heron and family, and by certain sea-birds. One of the jæger-gulls appears in two different styles, one white on the under side, the other sooty-black all over. The reddish egret (*Dichromanassa rufescens*) of Central America has a white phase long named separately as "Peale's" egret; and "Wurdemann's heron" is now considered merely a color-phase of the great white heron of Florida. The common little blue affords another example.

The only noticeable explanation ever offered for dichromatism is that it may indicate the beginning of a divergent, or "nascent" species, which might subsequently become fixed by birds of the same phase mating; but experiments with the screech-owl have shown that red and gray young will appear "whether both parents are red, or both gray, or one red and the other gray." Barrows states ('Birds of Michigan,' Lansing 1912) that it "has been shown that in captivity the gray bird can be converted into a red one by feeding regularly with liver, and by withholding this food afterward the bird has eventually resumed the gray plumage. This would seem to indicate that the color of the plumage may be largely influenced by the character of the food, yet it is difficult to see how this fact can be used to explain the conditions actually found in nature."

Consult Steineger, 'Birds' (Standard National History, Vol. IV, Boston 1885); Allen, *American Naturalist*, Vol. II, 1889, p. 327.

DICHROISM (Gr. *dis*, "twice," *chroa*, "color"), the property which many colored doubly refracting crystals have of exhibiting different colors in different directions. Thus the color of a green tourmaline appears very much darker in the direction of the vertical axis than when the crystal is viewed at right angles to that axis. As in many instances three colors are exhibited, the term "pleochroism" (Greek *pleon*, "more"; *chroa*, "color"), being of a more general character, is often used. A crystal of iolite (dichroite) appears blue in the direction of the vertical axis, yellowish-white in the direction of the macro-axis, and bluish-white in the direction of the brachy-axis. Dichroism is detected and measured by the instrument known as the dichroscope. This consists of a rhomb of Iceland spar with wedges of glass cemented at each end of it. These are enclosed in a metal cylinder with a lens at one end and a square opening at the other. If a section of a dichroic crystal is placed in front of the orifice and is viewed through the instrument, two colored squares are seen side by side, one corresponding to the ordinary ray, the other to the extraordinary ray. Dichroism may also be observed by means of the polarizing microscope, by removing one of the nicols and revolving the stage. This furnishes a method of determining in rock sections biotite, tourmaline, epidote and hornblende, all of which are dichroic. Thus hornblende is easily distinguished from augite, which is not dichroic. Optically uniaxial crystals, or those belonging to the tetragonal and hexagonal systems, are dichroic; optically biaxial crystals, or those belonging to the orthorhombic, monoclinic and triclinic system, are trichroic. Isotropic bodies, including isometric crystals and also amorphous substances such as opal and glass, transmit the same color in any direction. Dichroism, or the allied term "Dichromatism," has also been applied to those fluids which appear of different colors when viewed by reflected and refracted light; when seen in thick or thin layers, etc. For example, venous blood, or any blood impregnated with carbonic acid, hydrogen or nitrogen, appears, when seen in moderately thin layers, to be of a purple color; while in extremely thin layers it appears green. This property of marked color-variation is due to the difference in the absorption of the light-vibrations in different directions. The property of dichroism is a great aid to the jeweler in distinguishing gems. Diamonds, spinels and garnets show no dichroism; sapphire, ruby, emerald, beryl, tourmaline, topaz and chrysoberyl all have characteristic dichroism. Consult Fulton, A. E. H., 'Crystallography' (London 1911).

DICHROITE. See IOLITE.

DICK, Charles, American legislator: b. Akron, Ohio, 3 Nov. 1858. He was educated in the public schools, was admitted to the bar in 1893, and established his practice in Akron. He was in active service with the Eighth Ohio Volunteers during the Spanish-American War. In 1886–93 he was auditor of Summit County and in 1887–91 was chairman of the Republican county committee and of the Republican State executive committee in 1892–94 and 1899–1907. He was secretary of the Republican National Committee 1897–1900. He was delegate to the Republican National Conventions of 1892 and 1896, and delegate-at-large in 1900 and 1904. He was a member of the 55th to the 58th Congresses (1898–1904), and introduced the militia bill, known by his name, and which passed both houses. On 2 March 1904 he was elected to the United States Senate to succeed the late Marcus Alonzo Hanna. His term expired in 1911.

DICK, Mr., colloquial abbreviation for Richard Dabley, a character in Dickens's 'David Copperfield' (q.v.).

DICK, Sir Robert Henry, Scottish soldier: b. about 1785; d. 1846. He was son of a doctor in the service of the East India Company, joined the army in 1800, and as an officer took part in the Peninsular campaign, fighting at Busaco, Fuentes de Onoro and Salamanca. He gained added renown at Quatre Bras and Waterloo. He became major-general in 1837 and from 1841 to 1843 was acting commander at Madras. In the Sikh War of 1846 he was made commander of the third infantry division, and fell in leading a charge at Sobraon.

DICK, Thomas, Scotch theologian and educator: b. Dundee, 24 Nov. 1774: d. Broughty Ferry, 29 July 1857. He was educated at the University of Edinburgh for the ministry of the Secession Church. For two years he was pastor at Sterling. The next 20 years he taught school at Methven and Perth, and the last 20

years of his life he devoted to literary work. He wrote several volumes. Among them are 'The Christian Philosopher' (1823); 'The Philosophy of Religion' (1825); 'The Philosophy of a Future State' (1828); 'Celestial Scenery' (1838); 'The Sidereal Heavens' (1840); 'The Solar System' (1840); 'The Practical Astronomer' (1845). His writings were published in an edition of five volumes and later in an edition of two volumes.

DICK BEQUEST, a fund established in 1828 by James Dick of London with the object of encouraging active schoolmasters and to elevate the literary character of both teachers and schools. The fund is for the benefit of the parish schoolmasters of Aberdeen, Banff and Moray, Scotland, and now amounts to about $600,000, yielding about $20,000 annually, which is distributed as an honorarium among the teachers according to their acquirements in English, geography, mathematics, the classical languages, pedagogics, etc. Consult Kerr, J., 'Scottish Education, School and University from Early Times to 1908' (Cambridge 1910).

DICKCISSEL, dĭk-sĭs'sĕl, or **BLACK-THROATED BUNTING** (*Spiza americana*), a species of finch in which the male is easily distinguished by a conspicuous jet-black throat-patch on a light yellowish background; the upper parts in both sexes are grayish brown variously streaked above with both lighter and darker shades. During the nesting season the black-throated bunting inhabits cultivated fields of the eastern United States, especially southerly. It winters in South America. The song is a very simple unmusical ditty, and the nest is built on or very near to the ground.

DICKENS, Charles, English novelist: b. Landport, England, 7 Feb. 1812; d. Gad's Hill, near London, 9 June 1870. Dickens, who was christened Charles John Huffham Dickens, was the eldest son and the second child among eight of John and Elizabeth Dickens. His father was a navy-clerk in the Portsmouth dockyard at the time of the novelist's birth; thence he was transferred to London, and, when Charles was five, to Chatham. Here Dickens learned to read and got some schooling. The most important influence of this early life was his acquaintance with the great novelists of the preceding century, Fielding and Smollett, and also LeSage and Cervantes, all of whom had much effect on his own work. He also read much travel, and had a good deal of pleasure in the 'Arabian Nights' and the British essayists.

In 1821, the Dickens family returned to London, in straitened circumstances, and the following year the elder Dickens was confined in the Marshalsea for debt, through hard luck and misfortune rather than, as his biographers are careful to explain, any fault or misdemeanor of his own. The young Charles was put to pasting labels in a blacking warehouse in Blackfriars, much as his hero, David Copperfield, toiled in the warehouse of Murdstone and Grinby, though he was not ill-used. Beginning with 1824 he got two or three years of schooling of no very profitable sort, and found some employment, first as lawyer's clerk, and later as newspaper reporter. In order better to perfect his work in this field he learned shorthand and read with some system in the British Museum. For a time, probably, he thought of becoming an actor, whose profession always had great charm for him, but this was definitely abandoned when, in 1831, his toil was rewarded by his being made parliamentary reporter, and later, in 1834, a regular reporter on the *Morning Chronicle,* an important Whig newspaper. At his profession Dickens worked with great energy, but he found time also to begin the writing which led to his great popular fame.

This was a sketch entitled 'A Dinner at Poplar Walk,' and it was published early in 1834 in the *Monthly Magazine.* By the beginning of 1836, enough had been published in that paper and the *Evening Chronicle* to make a volume, which shortly appeared with the title, 'Sketches by Boz,' the nickname of his boyhood, which he used as a pseudonym for many years. The sketches were so successful that Dickens shortly found it profitable to buy back the copyright for 13 times the £150 that he had originally got for it. The same year (1836) he married Catharine Hogarth, eldest daughter of George Hogarth, the conductor of the *Evening Chronicle.*

The five years following the appearance of the 'Sketches' were marked by an enormous amount of production of varied and admirable quality and great popular success. In that year, at the request of Chapman and Hall, he began the 'Posthumous Papers of the Pickwick Club.' The original idea was to have a humorous running account of a party of unlucky sportsmen, illustrated with suitable pictures. The idea, after the first few numbers, took a more serious turn in Dickens' mind, and though the humor to the end remained unfailing, the characters grew in depth and intensity and became less caricatures by the time of the close of the publication in 1837. The book was almost instantly popular, it achieved success such as few books have had, and is to-day probably the most familiar of Dickens's writings.

In February 1837, while 'Pickwick Papers' was still in progress, there appeared the first instalment of Dickens' first regular novel, 'Oliver Twist.' Besides being a more coherent story than 'Pickwick,' though not, even so, a very closely knit narrative, this successor was of a type common in the author's later work; it had a purpose. Strong hints of the type are to be found in 'Pickwick,' as in the trial of Bardell vs. Pickwick and Mr. Pickwick's own imprisonment, in which scenes the intention is not wholly comic. In 'Oliver Twist' there is a deliberate representation, somewhat along the lines laid down by Fielding and Smollett, of the under side of life, and there is also an attack on the iniquity of the administration of charity schools and the poor law. The most intimate and affecting parts of the story are those dealing with the subterranean life of the young pickpockets and Nancy. Dickens' feeling for reform is even more poignant in the next novel, 'Nicholas Nickleby' (1838–39), where he fell upon the country schools in the person of the immortal Squeers and Dotheboys Hall. Critical opinion is in accord with regard to the infinite superiority of the portraits of the Squeers family, the actors, and the rest of those who are more or less taken from the author's own keen observation of life, to the conventional and unconvincing picture of the

«high» life in the novel. In Mrs. Nickleby, as earlier in Pickwick, and later in Mrs. Gamp, Mr. Micawber, Uriah Heep and many others, Dickens made an interesting addition to the gallery of permanent and popular portraits established by Chaucer, and added to by Shakespeare, Fielding, Sheridan and others.

After a false start in 'Master Humphrey's Clock,' there emerged 'Old Curiosity Shop' (1840), one of the author's most idyllic and pathetic books, published like all his earlier works, serially. He then essayed a historical novel, and in 'Barnaby Rudge' (1841) laid his scene at the time of the Gordon Riots, in the preceding century. It is a novel of pretty elaborate plot and uneven dramatic power and historical sense. As usual, in Dickens's work, the best parts deal with genre types and comedy characters rather than with conventional villainy or sentiment. During this period Dickens had not only written his stories but had written several plays, of which two, 'The Strange Gentleman,' a farce (1836), and 'The Village Coquette,' an operetta (1836), were successful, and had essayed the founding and editing of the weekly magazine in which 'Old Curiosity Shop' appeared.

Early in 1842, Dickens and his wife went to America, where he was warmly received and where his popularity was quite as great as in England. The result of the journey is to be found in the 'American Notes' published late in 1842, and, to a certain degree,—in those parts that satirize American life,—in the novel, 'Martin Chuzzlewit,' of which the first instalment appeared on the first day of 1843. This novel, in which Dickens in many respects, as in the immortal Pecksniff and Mrs. Gamp, reached the high-water mark of his comic and satiric power, ran for 20 monthly numbers. It was immediately followed by the first of his «Christmas Books,» which appeared each year from 1843 to 1846 and again in 1848. For about a year, 1844–45, with one return to London, he was with his family in Italy, of which sojourn 'Pictures from Italy' contains the record.

A short connection with the newly-founded radical journal *The Daily News,* early in 1846, was followed by another journey to the Continent. On this trip he began 'Dombey and Son,' the first number of which appeared in October 1846. Herein Dickens for the first time on an elaborate scale attempted a statement of a moral and spiritual, rather than a political and philanthropic, problem. In the misfortunes of Mr. Dombey he preached from the text that «Pride goeth before destruction.» It is on the ground of insufficient reality that the major characters of the book have often been criticised, but there is little dissent from the view that the minor characters are done with much of Dickens's characteristic power, or that the book was one of his great popular successes.

In 1847, Dickens began a series of intellectual diversions in the form of an organized amateur theatrical company, which included many well-known men of letters of the time—R. H. Horne, Mark Lemon, Mrs. Cowden Clarke, Wilkie Collins and others—and which gave successful amateur performances in various places in England. Performances of Jonson's 'Every Man in His Humor' were given in Manchester and Liverpool, in July, with great success, and the following year this play alternated with 'The Merry Wives of Windsor' in London and five large towns of the kingdom. Many of the performances were for the benefit of indigent actors and men of letters, and a performance in 1851 of 'Not So Bad as We Seem,' written for the occasion by Bulwer Lytton, was acted before the queen for the benefit of the Guild of Literature and Art. During 1852, also, the company gave many representations in various parts of the country. Throughout the five years of its existence Dickens was manager of the company.

Meanwhile (May 1849–November 1850), what is commonly regarded as Dickens's masterpiece of narrative fiction, 'David Copperfield,' appeared. Dickens himself thought more highly of the novel than of any of the others, and looked upon it with much affection. The reason for both the popular and the author's judgment probably lies in the autobiographical character of the book. That is to say, Dickens here speaks more profoundly from his own experience, tells with more closeness and reality the tale of his early days, and introduces a larger number of those inimitable characters, which, however comic and retouched, are founded on his own observation of actual life. "The humorous passages, the idyllic and the pathetic passages are unexcelled by any of his other work." On the other hand, though there are many traces and delineations of the conventional villain type and some soundings of the sentimental *motif,* these are not so marked as in such earlier novels as, for example, 'Nicholas Nickleby.' In short, Dickens, in 'David Copperfield,' followed more closely than in any of his preceding novels the groundwork of his own knowledge and experience, at the same time losing no whit of his quality and humor. Criticism and popular verdict alike assign to this novel a very high place in English fiction.

Before the completion of 'David Copperfield,' Dickens had started (30 March 1850) a monthly periodical, *Household Words.* The design was to furnish an inexpensive and at the same time cheery and wholesome periodical for popular consumption. Its idea was to be pleasant and imaginative rather than sensational and literal. To this Dickens himself contributed the novel 'Hard Times' (1854), and some of Mrs. Gaskell's novels also saw the light through its pages. Coming to an end in 1859, it was followed at once by the similar periodical, *All the Year Round.*

Three novels which followed are of somewhat different types from 'David Copperfield' and by themselves. 'Bleak House' (March 1852–September 1853) was more of an attempt at intricate plot construction than had been tried in the earlier novels that depicted the fortunes of a hero, and it attacked vigorously the law's delays by making the Court of Chancery, as it were, the centre of interest of the story. Interrupting the course of his novels by 'A Child's History of England' (1853), he produced after that 'Hard Times,' one of his most didactic works. The moral was a general one; we should cultivate the virtues of charity and fondness for the poor that we have always with us against the evil days wherein hardness of heart will be our bane. More satirical and specific in its application was the attack on the «Circumlocution Office» which forms the burden of

'Little Dorrit' (December 1855-June 1857). Its animus was a hatred of war and a wish to satirize the war office because of several breakdowns in the machinery of the Crimean War, then just ended. Of these novels, 'Bleak House' attained an extraordinary amount of popularity, even surpassing 'David Copperfield' in that respect.

On 20 April 1858, Dickens began on the large scale, that he carried out into the year of his death, the famous series of readings from his works. As early as 1853 he had given occasional public readings, but, until 1858, never in an extensive and systematic way. At the outset he read with the text before him, but he soon memorized the scenes, worked up the "business," and cultivated a dramatic action which so grew in intensity, that toward the close of his life, his reading became almost acting. The success of this almost wholly new departure in the career of an author was startling. His first course consisted of 81 readings in three and a half months, and this was followed by shorter courses. His most successful and arduous courses were a series of 80 readings in America, in 1857–58, which brought him nearly £20,000, and a farewell course of 100 readings in England the following winter, which were worth £8,000, besides expenses and percentages. The motive that induced Dickens to give these courses was a growing restlessness, the need of activity, and a craving for applause, rather than any pecuniary necessity. As it was, they were a very great tax on his strength and they undoubtedly shortened his life.

In 1859 he gave comparatively few readings, and the following year none. He was then chiefly occupied with the new *All the Year Round*, in which appeared his second and last historical novel, 'A Tale of Two Cities' (April–November 1859). This story of the French Revolution was written with more deliberation, care for construction and succinctness than his previous works, and, in spite of its comparative lack of humor and spontaneity, Dickens thought highly of it, though he went back in his succeeding novels to his more free and easy way. A series of sketches, 'The Uncommercial Traveller,' was begun in 1859, shortly after he had taken up his abode at Gad's Hill Place in Kent, and this change, with its incident trips to London, furnished him material for his work. The effect of the change also appeared in his next novel, 'Great Expectations' (in *All the Year Round* in 1860), which reverted in many respects to the earlier style of 'David Copperfield.' More reading then interrupted the course of his novel writing, and it was not until 1863 that he set to work on his last complete story, 'Our Mutual Friend' (May 1864–November 1865). Many of the passages of this novel have been greatly admired, but opinion is fairly uniform that it, as a whole, lacks the movement and glow of Dickens' earlier novels and shows signs of the strain under which he was laboring.

A short last course of lectures was delivered between January and March 1870. Then appeared the first instalment of 'The Mystery of Edwin Drood.' The afternoon of 8 June he finished the sixth number of the story. The next day he was suddenly stricken and died at about six in the evening. He was buried in Westminster Abbey.

With the possible exception of Scott, no English novelist has been, and probably still is, so widely popular as Dickens, both in his own country and abroad. His great contemporary Thackeray was not so extensively read in his lifetime, and none of his successors who, like George Eliot, may not unreasonably be regarded as approximating his high place, have been so much beloved. Dickens' manner of expression has had a wide effect on popular style, and many of his sentiments, as well as a whole galaxy of characters, have become common property. Foreign writers, like Daudet, have to some degree imitated his style. Furthermore, few writers have had so long continued a vogue. Single novels, like 'Uncle Tom's Cabin,' may have surpassed any of Dickens' works, and several contemporary novels have had marvellous success, but with the exception of Scott, there is in English fiction no instance of such widespread and lasting popularity for so long a succession of novels. Of late years there has been some critical disparagement of Dickens as an artist, but it is doubtful if this has in any way affected his popular vogue or lessened the solid esteem that people feel for him.

The reasons for his great success and the just estimation in which he is held are usually accounted to be the marvelous vitality and resourcefulness of his characterizations, the copious and rapid, though lengthy, movement of his narrative, and the unfailing spring of his humor. His power of seeing effects in situations and humors in character and of depicting them with a few salient strokes have probably been the cause of his adding more figures to the common store of characters than any writer since Shakespeare. Most of these figures, it has frequently been observed, are taken from the lower strata of society; with the so-called higher classes he is uniformly less successful, and in some instances wholly unconvincing. His natural habit of mind and his training as a reporter early gave him the faculty of taking in a large number of details at a glance, and his boyhood experience and his active life in London had furnished him with an abundance of material. The subtler effects of a more refined or intellectual society were foreign to his early impressions and were beyond the scope of his swift, definite delineation. In this respect he would fall short of Fielding, Scott and Thackeray as an analyst of various human life, but outside of these three writers it is doubtful if any English novelists have so great a range of characterization. Certainly no English novelist has depicted a greater number of characters. His performance remains, in spite of attempts to disparage his genius, one of the most vigorous and lasting in English literature. See DAVID COPPERFIELD; GREAT EXPECTATIONS; OLIVER TWIST; PICKWICK PAPERS; A TALE OF TWO CITIES.

Bibliography.—Standard editions of Dickens are numerous. One of the most recent is Kitton, 'The Autograph Edition of Complete Works' (56 vols., New York 1902). The chief life is that by his friend John Forster, 'The Life of Charles Dickens' (London 1872–74). Among other books may be mentioned: Chesterton, 'Life of Charles Dickens' (New York 1906); Fields, 'Yesterdays with Authors' (Boston 1872); Fitzgerald, 'The History of Pickwick' (London 1891); id., 'Life of Charles

Dickens as Revealed in his Writings' (ib. 1905); Fitzgerald, P. H., 'Memoirs of Charles Dickens' (London and New York 1914); Gissing, 'Charles Dickens: A Critical Study' (New York 1898); Hogarth and Dickens, 'Letters of Charles Dickens' (London 1882); Hughes, 'Dickens as an Educator' (New York 1900); Kent, 'Charles Dickens as an Actor' (London 1872); Kitton, 'The Novels of Charles Dickens' (ib. 1897); Lehmann, 'Charles Dickens as an Editor' (New York 1912); Marzials, 'Life of Charles Dickens' (1887); Pemberton, 'Charles Dickens and the Stage' (London 1888); Pugh, 'The Charles Dickens Originals' (ib. 1912); Thomson, 'Dickens Bibliography' (Warwick 1904). Consult also Cross, W. L., 'The Development of the English Novel' (New York 1899).

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DICKENS, Charles, English editor: b. 1837; d. Kensington, England, 20 July 1896. He was the eldest son of the preceding; was educated at King's College, Eton and at Leipzig; became assistant to his father as editor of *All the Year Round* and subsequently chief partner in a printing firm. He edited a 'Life of Charles Mathews'; 'The Dictionary of London'; 'Paris and the Thames'; and a complete edition of his father's works.

DICKENS, Mary Angela Evans, English novelist. A granddaughter of Charles Dickens. Her best-known novel is 'A Mere Cipher' (1893). She has also written 'Cross Currents' (1892); 'Prisoners of Silence' (1895); 'Against the Tide' (1897); 'On the Edge of a Precipice' (1899); 'The Wastrel' (1901); 'Unveiled' (1907); 'The Debtor' (1912).

DICKIE, George William, American engineer: b. Arbroath, Scotland, 17 July 1844. He studied engineering in his father's shipyard, and with the North British Railway Company, and came to the United States in 1869. He was engaged in steamship work on the Pacific Coast, designed machinery for the Comstock mines, became president of the Union Iron Works in 1883, giving especial attention to naval work. In 1905 he became consulting marine and mechanical engineer of San Francisco. He was at one time president of the Technical Society of the Pacific Coast. He has written 'Pumping and Hoisting Works' (1876) and numerous papers and articles.

DICKINS, John, American Methodist clergyman: b. London, England, 24 Aug. 1747; d. Philadelphia, Pa., 27 Sept. 1798. He was educated at Eton and emigrated to America prior to the American Revolution. Embracing Methodism in 1774, he entered the ministry, becoming one of the most notable preachers of his day. He was instrumental in founding Cokesbury College, Maryland, and the Methodist Book Concern.

DICKINSON, Anna Elizabeth, American orator, novelist and playwright: b. Philadelphia, 28 Oct. 1842. At the outbreak of the Civil War she became known as a speaker, and under the stimulus of the great events became an orator of great power and persuasiveness, who created by her youth, real pathos and brilliant rhetoric the greatest enthusiasm wherever she was heard. Her prominence was gained mainly by her fiery addresses on total abstinence, abolition, politics and woman suffrage. After a time she devoted her whole attention to lecturing and to the drama. She was called the "Joan of Arc" of the War. Some of her books are 'What Answer' (1868), a novel; 'A Paying Investment' (1876); 'A Crown of Thorns' (1876); 'A Ragged Register of People, Places and Opinions' (1879). She was the author of two plays of excellent dramatic quality, 'Anne Boleyn' and 'Marie Tudor' (1875), in which she played the title rôles.

DICKINSON, Charles Monroe, American author and diplomat: b. Lowville, N. Y., 15 Nov. 1842. He attended school at Lowville Academy and Fairfield Seminary, and was admitted to bar 1865; and practised law in Binghamton and New York 1865–78. He was editor and proprietor Binghamton *Republican* 1878–1911. It was upon his suggestion and initiative in 1892 that the several news organizations in this country were combined into the present Associated Press. He was presidential elector 1896; and in 1897 was appointed by President McKinley United States consul-general to Turkey. From 1901–03, he was diplomatic representative to Bulgaria. While serving in this capacity, the American missionary, Ellen M. Stone, was carried off by brigands and, through his efforts and settlement, she was released. He was appointed member of the board to draft rules and regulations for the American consular service, 1906; American consul-general-at-large, 1906 to 1 Oct. 1908, when he resigned because of fatal illness in his family. He is a member of the Authors' Club of New York; president of the Barlow Board of Industrial Arts of Binghamton. Author of 'The Children and Other Verses' and 'The Children after Fifty Years' (1915); also part of 'Political History of the State of New York' (1911).

DICKINSON, Daniel Stevens, American lawyer: b. Goshen, Conn., 11 Sept. 1800; d. New York, 12 April 1866. He was admitted to the New York bar, where he soon became prominent; was elected to the State senate in 1836, and became a leader in the Democratic party, which made him lieutenant-governor in 1842, and in 1844 sent him to the United States Senate. There he became known for his pro-slavery and States-rights proclivities, and was made chairman of the Finance Committee. He was brought forward as a candidate for the presidency in 1852, but without success. He spent the later part of his life at Binghamton, N. Y., in the practice of his profession. His 'Life and Works' was published in 1867, two volumes.

DICKINSON, Donald McDonald, American lawyer: b. Port Ontario, N. Y., 17 Jan. 1846; d. Trenton, Mich., 15 Oct. 1917. He was graduated at the law department of the University of Michigan in 1867, and began the practice of law in Detroit, where he rapidly rose to a foremost position at the bar; and later practised in Washington, D. C. He was conspicuous in politics as a Democrat; was secretary of the Democratic State central committee, which managed the Greeley campaign in 1872; withdrew from the Democratic party, but was won back by Mr. Tilden; and was chairman of the Democratic National committee in 1876; and a member of the committee in 1884–85. He was Postmaster-General of the United States in 1887–89; chairman of the Democratic National campaign committee in

1892; and senior counsel for the United States before the Joint High Commission on Bering Sea claims, under the Fur Seal Arbitration in 1896–97. He was a member of the Court of Arbitration to adjust the controversy between the United States and the Republic of Salvador in 1902.

DICKINSON, (Goldsworthy) Lowes, English author, son of the artist, Lowes Dickinson. He was educated at the Charterhouse and at King's College, Cambridge, of which he became Fellow and lecturer. He was also appointed lecturer at the London School of Economics and Political Science. He has been particularly happy in adapting the dialogue as his literary medium. His published works include 'The Greek View of Life' (1890; 3d ed., 1906); 'From King to King: The Tragedy of the Puritan Revolution' (1891; 2d ed., 1907); 'Revolution and Reaction in Modern France' (1892); 'The Development of Parliament during the Nineteenth Century' (1895); 'Letters from a Chinese Official' (1903), which was answered by W. T. Bryan in 'Letters to a Chinese Official' (1906); 'Religion: A Criticism and a Forecast' (1905); 'A Modern Symposium' (1905); 'Justice and Liberty' (1908); 'Is Immortality Desirable?' (1909); 'Religion and Immortality' (1911). Consult Chesterton, G. K., 'Heretics' (London 1909); More, 'Shelburne Essays' (Vol. VII, New York 1910).

DICKINSON, Jacob McGavock, American lawyer and public official: b. Columbus, Miss., 30 Jan. 1851. He was graduated at the University of Nashville in 1871, studied law at Columbia College, New York, also at Leipzig and Paris. In 1874 he was admitted to the bar and practised at Nashville from 1874 to 1899, and in Chicago from 1899 to 1909. He served several times by special commission on the supreme bench of Tennessee, was assistant Attorney-General of the United States in 1895–97, Federal solicitor in 1899–1901 and from 1901 to 1909 was general counsel of the Illinois Central Railroad. In 1909–11 he served as Secretary of War in the Cabinet of President Taft. In 1907–08 he was president of the American Bar Association. Since 1915 he has served as receiver of the Rock Island Lines.

DICKINSON, John, American political writer and statesman: b. Talbot County, Md., 13 Nov. 1732; d. Wilmington, Del., 14 Feb. 1808. In 1740 he removed with his father to Delaware. He studied law in Philadelphia in 1750, in 1753 was entered at the Middle Temple, London, and in 1757 began to practise in Philadelphia. He was elected to the Delaware assembly in 1760 and two years later to the Pennsylvania assembly. He served with distinction till 1765 and again in 1770–76. In 1774–76 he was a member of the Continental Congress. He also served in the American army, attaining the rank of brigadier-general in the Delaware militia. In 1781–82 he was governor of Delaware and in 1782–85 was governor of Pennsylvania. He was prominent in the debates of the Constitutional Convention of 1787, but is best known as a writer of State papers and pamphlets; these included 'Address to the Inhabitants of Quebec'; 'Petitions to the King'; 'Address to the Armies'; 'Articles of Confederation' (first draft), that had great influence in their day. He was the author of 'Letters from a Pennsylvania Farmer to the Inhabitants of the Colonies' (1767); 'Essay on Constitutional Power of Great Britain over the American Colonies' (1774). He opposed the Declaration of Independence and refused to sign it. His influence waned after 1776 on this account. His 'Writings,' edited by Paul L. Ford, were published at Philadelphia (1895). Consult Stillé, 'Life and Times of John Dickinson' (Philadelphia 1891) and Tyler, 'Literary History of the Revolution' (New York 1897).

DICKINSON, Jonathan, American Presbyterian clergyman: b. Hatfield, Mass., 22 April 1688; d. Elizabethtown, N. J., 17 Oct. 1747. He was graduated at Yale College in 1706 and soon afterward was installed as pastor of the Presbyterian congregation in Elizabethtown, N. J., which relationship continued until his death. After the separation of the New Jersey churches from the synod of Philadelphia in 1741, it was determined to establish a collegiate institution in the former colony, and a charter for the College of New Jersey (now Princeton University) was obtained. The first classes were opened in Elizabethtown and Dickinson was elected president. His writings on theology were collected at Edinburgh (1793).

DICKINSON, Martha Gilbert, American poet: b. Amherst, Mass. She is a niece of Emily Dickinson, and was married to Alexander E. Bianchi, 24 July 1903. She has published 'Within the Hedge'; 'The Cathedral and Other Poems' (1901); 'A Modern Prometheus' (1908); 'The Cuckoo's Nest' (1909); 'Russian Lyrics and Cossack Songs' (1910); 'The Sin of Angels' (1912); 'Gabrielle and Other Poems' (1913); 'The Kiss of Apollo' (1915); and also contributions to magazines and literary periodicals.

DICKINSON, Mary Lowe, American educator and author: b. Fitchburg, Mass., 1839; d. New York, 8 June 1914. She was married to John B. Dickinson, a New York banker, and after his death taught in schools in Boston, Hartford and New York, being for some time principal of the Van Norman Institute in the last-named city. She edited the *Silver Cross* magazine for 10 years and was the editor of *Lend a Hand*. She published several volumes of fiction and a collection of poems; also many short stories and much general literary work.

DICKINSON, Peard, English clergyman: b. Topsham, England, 16 Nov. 1758; d. London, 15 May 1802. In 1779 he completed his university course and took his M.A. degree at Saint Edmund's Hall, Oxford. For three years he was curate of the noted rector of Kent, Vincent Perronet. In 1786 he became assistant to Charles Wesley at the New Chapel. He had the complete confidence of John Wesley. Mr. Dickinson was the author of a life of Melancthon. His life was written by Joseph Benson and published in 1803.

DICKINSON COLLEGE, a coeducational institution in Carlisle, Pa., founded in 1783, under the auspices of the Presbyterian Church. The charter of the college was granted by the general assembly of the State as the result of an appeal by the leading men of the Commonwealth, including Benjamin Rush and John Dickinson. It was named after the latter in

memory of his important services to his country and in commemoration of his donation to the college of 200 acres in York County, 500 acres in Cumberland County, $500 in cash and a number of valuable books. The college began its work in 1784. In 1798 the present site was purchased from the Penns for $150. The first building was destroyed by fire, but another, now known as West College, was erected by popular subscription in 1804. In addition to West College, the other buildings are South College (1835), East College (1836), the Law School (1877), Tome Scientific Building (1884), Gymnasium (1884), Bosler Memorial Library Hall (1885), Denny Memorial Hall (1896). The government of the school was changed somewhat in 1833, and it came under the charge of the Methodist Episcopal Church. The degrees conferred by the college are B.A. and B.S. The annual income amounts to about $50,000. In 1916 the number of students enrolled was 501 and the number of volumes in the library was 34,000.

DICK'S COFFEE HOUSE, a house in London, of which Richard Torner was the first proprietor, about 1680; from him it was called "Richard's" and later received its present name. It is now No. 8 Fleet street, near the Temple.

DICKSON, Baron **Oskar von,** Swedish merchant: b. Göteborg, of Scottish ancestry, 1823; d. 1897. He was a member of many learned societies and was a liberal contributor to the support of various Arctic expeditions. He was ennobled in 1880 and in 1885 was made baron. Dickson Harbor in the Arctic regions is named from him.

DICKSON, Sir **James Robert,** Australian statesman: b. Plymouth, England, 1832; d. 1901. He received his education in Glasgow and entered the City of Glasgow Bank. In 1854 he emigrated to Australia, settling at first in Victoria, then in New South Wales and finally, in 1862, in Queensland. He was elected to the Queensland Assembly in 1872 and in 1876 became Minister of Public Works in Macalester's Cabinet. In 1876–79 he was treasurer of the colony and again in 1883–87. In 1889–92 he lived in Europe; in the latter year he was again elected to the House of Assembly and re-elected in 1893 and 1896. He became Secretary for Railways in the Nelson Cabinet of 1897; became Secretary for Home Affairs in March 1898 and Premier in the month of October following. He favored the establishment of an Australian commonwealth, secured a referendum on the question and obtained a majority in favor of federation. He resigned the premiership in November 1899 and a month later was appointed Chief Secretary in the Robert Philp Cabinet. In 1900 he was Queensland delegate to London to discuss matters in relation to the proposed commonwealth. He became Minister of Defense in the First Federal Cabinet, was knighted but died within a few days after the inauguration of the new federal government.

DICKSON, Leonard Eugene, American mathematician: b. Independence, Iowa, 22 Jan. 1874. He was graduated at the University of Texas in 1893 and later studied at the universities of Chicago, Paris and Leipzig. In 1897–99 he was instructor in mathematics and in 1899 assistant professor of mathematics in the University of California. In 1899–1900 he was associate professor of mathematics in the University of Texas and in 1900–07 was associated professor, and after 1910 professor of mathematics in the University of Chicago. In 1900 he served as research assistant at the Carnegie Institution, Washington, D. C. He is editor of the 'Transactions of the American Mathematical Society,' the *American Mathematical Monthly*. He is author of 'Linear Groups, and Exposition of the Galois Field Theory' (1901); 'College Algebra' (1902); 'Introduction to the Theory of Algebraic Equations' (1903); 'Linear Algebras' (1914); 'Theory of Equations' (1914); 'Algebraic Invariants' (1915).

DICKSON, Samuel Henry, American physician: b. Charleston, S. C., 20 Sept. 1798; d. Philadelphia, 31 March 1872. He was graduated at Yale College in 1814 and immediately after commenced the study of medicine in his native city. He was instrumental in the establishment of a medical college in Charleston, and on its organization in 1824 he was called to the chair of institutes and practice of medicine. In 1858 he was called to the chair of practice of medicine in the Jefferson Medical College, Philadelphia, which he held till his death. He was author of 'Manual of Pathology and Practice of Medicine'; 'Elements of Medicine' (1835); 'Essays on Pathology and Therapeutics (1845); 'Essays on Life, Sleep, Pain, etc.' (1852). It is a fact worthy of note that he delivered the first temperance address ever heard south of Mason and Dixon's line.

DICKSON, William Purdie, Scottish theologian: b. Pettinain Manse, Lanarkshire, 22 Oct. 1823; d. 1901. He received his education at the University of Saint Andrews. In 1863 he became professor of divinity in the University of Glasgow and in 1895 was made professor emeritus. He translated Mommsen's 'History of Rome' (4 vols., rev. ed., 1895); 'Roman Provinces' (1887) and Meyer's 'Commentary on the New Testament' (10 vols., 1873–80). He delivered the Baird lectures of 1883, 'St. Paul's Use of the Terms Flesh and Spirit (1883).

DICKSON CITY, Pa., borough in Lackawanna County, five miles north of Scranton, on the Delaware and Hudson and the New York, Ontario and Western railroads. It is a coal mining centre and contains foundries and machine shops and silk mills. The government is vested in a burgess and a unicameral council. Pop. 11,198.

DICLINOUS, dīk'lĭ-nŭs or dī-klī'nŭs, a Linnæan term for flowers possessing stamens or pistils only — *Monœcia, Diœcia* and *Polygamia.*

DICOTYLEDONS, a subdivision of the angiosperms, or plants with encased ovules, which is characterized by the fact that the embryo has at least two (sometimes more) cotyledons or seed leaves, whereas the monocotyledons (q.v.), the other subdivision of the angiosperms, have only one. Besides this almost invariable characteristic, others of nearly equal constancy are the structure of the stem, which consists in the mature plant of a wood layer surrounding a pith, and separated from the last layer enclosing it by a zone of active growth, the cambium; the forked, anastomosing venation of the leaves, with free veinlets ending in the margin, which may be lobed or

toothed; and the prevalently quaternary or quinary symmetry of the flower, as opposed to the usual ternary symmetry of the monocotyledons. There is a very interesting difference between the development of the embryo of the dicotyledons and that of the monocotyledons. In both cases, the cell formed by the union of the two gametes gives rise to a filament of cells placed end to end, the so-called *proembryo*. In the dicotyledons, the terminal cell by dividing generates the entire embryo except the tip of the hypocotyl, which is formed from a portion of the next cell. In the monocotyledons, the terminal cell forms only the cotyledon, while the whole remainder of the plant is formed from a part of the next cell. The dicotyledons group themselves into two great series: the *Choripetalæ*, with free petals and sepals; and the *Sympetalæ*, with the petals coherent. Those *Choripetalæ* which lack a corolla together with a few related forms are known as the *Monochlamydeæ*, as opposed to the *Dialypetalæ*. The orders of *Monochlamydeæ* are the *Verticillatæ*, containing the cassowary trees; the *Juglandifloræ*, or walnuts, *Quercifloræ*, or relatives of the oak, *Salicioræ*, or willows and poplars, and *Urticinæ*, containing the elms, mulberries, nettles, etc., all of these orders being characterized by the possession of catkins consisting of unisexual, wind-fertilized simple flowers, the *Loranthifloræ*, containing the mistletoe; the *Piperinæ* or peppers; the *Hamamelidinæ* or relatives of the witch-hazel; the *Tricoccæ*, typified by the spurge; and the *Centrospermæ*, such as the rhubarb, spinach, pink, cactus, etc. The orders of *Dialypetalæ* are the *Polycarpicæ*, to which belong the water-lilies, crowfoots, magnolias, etc., usually with free carpels and a spiral arrangement of some parts of the flower; the *Rhœadinæ*, to which belong the poppies, mustards, etc., the *Cisitifloræ*, among which are the violets and the tea plants; the *Columniferæ*, often with a large number of stamens in a single whorl, containing the mallows, cocoa-tree, etc.; the *Gruinales*, containing the allies of the geranium; the *Sapindiæ*, among which are the sumachs, maples and horse-chestnuts; the *Frangulinæ*, with the grape vine and its allies; the *Saxifraginæ*, with the currants, gooseberries, etc.; the *Rosifloræ*, containing the rose, apple, strawberry, plum, etc.; the *Leguminosæ*, with a pod for a fruit and with flowers usually bilaterally symmetrical, to which belong such forms as the bean, pea, clover and lentil; the *Passiflorinæ*, such as the begonia, papaw and passion-flower; the *Thymelæinæ;* the *Myrtifloræ;* with the myrtle and eucalyptus; and the *Umbellifloræ*, or dogwoods, ginsengs, carrots, parsleys, etc., in most of which the flowers are borne in simple or compound umbels. The *Sympetalæ* are divided into the *Pentacyclicæ*, with two whorls of stamens, and the *Tetracyclicæ*, with one. The *Pentacyclicæ* consists of the *Ericinæ*, or heath allies; the *Diospyrinæ*, containing the persimmon, ebony tree, naseberry, etc.; and the *Primulinæ*, typified by the primrose. The orders of the *Tetracyclicæ* are the *Contortæ*, to which belong the olive, lilac, gentian, milkweed, etc.; the *Tubifloræ*, such as the morning-glory and mint; the *Personatæ*, among which are the potato, jimson-weed, foxglove, plantain, etc.; the *Rubinæ*, containing the coffee plant, elder and valerian; the *Companulinæ*, or bell-flowers, lobelias and gourds; and the vast assemblage of the *Aggregatæ*, characterized by the grouping of the flowers in heads with a common involucre and the reduction of the calyx of the separate flowers. This last order, which contains daisies, asters, thistles, sun flowers, tansies, yarrows, etc., possesses at least 12,500 species. The total number of dicotyledonous species is not less than 103,000 whereas there are only about 25,000 monocotyledons.

DICROTIC WAVE, a double beating, as in the human pulse. Each pulse-wave begins with an ascent corresponding to the systole of the heart. This ascent usually forms, as registered by the sphygmograph, an unbroken line until the apex of the curve is reached and the descent commences. The descending curve is marked by several minor waves, one of which being quite pronounced is known as the dicrotic wave, and is probably due to a reflection of the arterial tension on the periphery.

DICTAMNUS. See DITTANY.

DICTAPHONE, an adaptation of the phonograph to the needs of business correspondence or other work of a literary character, taking the place of the stenographer. The machine carries a waxen cylinder on which it records the spoken words of the dictator. This cylinder is afterward placed in a transcribing machine at the typist's desk, and the typist writes the letter or other matter direct from the record. After the letters have been transcribed the cylinder is placed in a shaving mechanism, the grooved surface removed, and the cylinder is then ready to record a new series of dictations. Each cylinder will thus serve to record from 1,000 to 1,200 average letters. All the mechanical movement necessary is supplied by electric motors, controlled by switches. The advantages claimed for the machine are the saving of the stenographer's time in toto; the saving of a part of the dictator's time often consumed in waiting upon the leisure of the stenographer, in halts where the speed is too great, and in repetitions; and the opportunity afforded to the typist of checking the work by a complete repetition of the original dictation exactly as it was given.

DICTATOR, an extraordinary magistrate of ancient Rome, first appointed 501 B.C. At first no one was eligible to the office who had not been previously a consul. The power of naming a dictator, when an emergency arose requiring a concentration of the powers of the state in a single superior officer, was vested by a resolution of the Senate in one of the consuls. A plebeian dictator was first appointed 356 B.C. The dictatorship was limited to six months, and the person who held it could not go out of Italy and could not touch the treasury. The dictator had the power of life and death, and could punish without appeal. All the other magistrates were under his orders. He had 24 lictors, double the number allowed to a consul. Such were the dictators appointed to carry on the government of the state in special emergencies; but dictators were often appointed for temporary purposes, especially during the absence of the consuls. The object of these temporary appointments was generally to secure the discharge of some function which could only be lawfully performed by the first magistrate, as the holding of the comitia (or meetings) for the

elections. The last dictator entrusted with the government of the state under the republic was appointed 216 B.C., the last temporary dictator 202 B.C. The office was revived by Sulla 82 B.C., and afterward held by Cæsar 48 B.C., but in these cases the legal restrictions were not regarded, and the office bore no resemblance but in name to the ancient dictatorship. It was abolished during the consulship of Antonius, 44 B.C. In modern times the term is loosely applied to usurpers who have arrogated to themselves extraconstitutional powers. The rulers of Paraguay bore the title of dictator for a number of years, and those of other Spanish-American countries have done so from time to time. Consult Greenidge, 'Roman Public Life' (London 1907); Mommsen, 'Römische Staatsrecht' (3d ed., Leipzig 1887).

DICTIONARY (Low Latin *dictionarium*, first used in the 14th century; from *dictio*, post-classical synonym for *verbum*, word). The various applications of the term, general and special, are so familiar that a detail would be of no service. Of its synonyms, it may be said that the Greek word "lexicon" is customarily restricted to a dictionary of ancient or Oriental languages, with definitions, etc., in the language of the supposed reader; "glossary" and "vocabulary" to dictionaries of the terms used in the special works to which they are attached. A glossary (called by the Germans *idioticon*, by the Italians *vocabolario*) is a defined list of unusual, antique or foreign words; a vocabulary, in classical works sometimes called an index, belongs to a book in or text-book of a foreign language, and renders the foreign words into the reader's language, or the exercises of the latter into the foreign.

The modern use of the term "dictionary" is not limited to a simple compilation, but has been extended to technical and other subjects, in which alphabetical arrangement of topics is maintained. Thus at present there are biographical, bibliographical, geographical, mathematical, historical, philosophical, medical, musical, rhyming and other dictionaries.

Functions.— The variation of kind with the variation of users and origin, common to all literature, is well exemplified in dictionaries. The original dictionary was a simple definer of words which a cultivated reading class was supposed not to know,— foreign, provincial, technical, obsolete, etc.; the modern dictionary of its own language attempted to exclude nearly all but the accepted vocabulary of current literature,— that is, what people knew already,— or at least what would be needed for such reading; the later ones increasingly include the means of understanding everything ever printed in a language. Two classes only, for obvious reasons, are still excluded (one of which the older ones gave), by reason of the change in audience from men to women and children: gross words, except a few too important philologically to be spared; and argot. The "abridged" dictionaries for many years, with ludicrous logic, excised the difficult words and retained the familiar ones; the first to exercise common-sense and reverse this plan was Jabez Jenkins in his wonderful "vest-pocket lexicon," whose nearly 30,000 words contained almost all the unusual ones and the pronunciational cruces. The attempts to draw a line in full dictionaries are now recognized as injudicious: that a word or form of a word has gone out of use is the very reason it should be defined or at least cross-referenced. An incomplete record of the language is by so much unserviceable. Part of the exclusions resulted from the growth of a half-educated middle class who looked to it as a standard of taste. The French Academy at first omitted all technical terms, and all words assumed below its standard of elegant usage; but as this made the book half useless, and the omissions were credited to the Academy's ignorance or carelessness instead of its fastidiousness, it could not be maintained. Recent dictionaries attain the same end by marking words as "obsolete," "little used," "provincial," "colloquial," "slang," "vulgar," etc. The attempted arbitrament of pronunciations, though inevitable (being among the chief services for which they are consulted), will always remain a battle-ground embarrassing even to the umpires. Still more important, however, is a dictionary's value for the historical development of a language. No dictionary fulfils its best purpose which does not, as far as possible, trace the varying significations from their sources, with their development by metaphor or technical use; and any arrangement which obscures this is vicious; whatever temporary convenience may be subserved. As the validity of this development depends on citation of passages, these should be full, otherwise we have only the arbitrary assertion of the compilers. Back from even this lie the original etymologies of the words, which are of great value and even more interest; and the best dictionaries give them with their affiliations in other languages. All the irregular grammatical forms, and the particles by which words are inflected,— a sufficient grammatical apparatus for correct usage,— should be given as a matter of course. Syllabifications, divisions, etc., should also be indicated: in a word, the dictionary is a proof-reader's vademecum, and must contain all requisite material for him to use.

Arrangement.— The first condition of usefulness being that the items shall be easily found, no arrangement is tolerable except an alphabetical one, in all languages where the inflections are mainly terminal or after a consonant initial. This arrangement, however, may be used only in a key, making feasible other classifications for the main body; as in Roget's well-known 'Thesaurus' of synonyms, where the grouping is by ideas, in parallel column with the reverse ideas. This would be a very useful addition to the meagre lists of synonyms given in the large dictionaries; but it would need great labor and almost impossible accuracy of cross-referencing, as the group heads must be referred to from each word in its alphabetical place. A very useful variant is in the lists of technical terms of arts and sciences given under each main head in the 'Standard Dictionary.' Rhyming dictionaries are arranged alphabetically under the terminations. In etymological dictionaries, attempts have been made to alphabetize by roots; but as no two scholars ever agree on the roots, the finding is largely guesswork, unless with a full alphabetical key, and scholars condemn the plan. In Semitic languages the arrangement is usually by roots. It was this necessity of arranging Volapük dictionaries, owing to the prefix-inflection involving a search in three or four places for one word, which as much as anything else prevented

that "language" gaining favor. The arrangement of Chinese characters is almost incapable of any readily intelligible system, and is not settled by sinologists.

History.— The first dictionaries were used by the Assyrians and Babylonians, to explain not words, but signs. The ancient ideographs, when largely displaced by syllabified or alphabetic signs with phonetic values, rapidly became unintelligible; and syllabaries were therefore compiled, to define them in terms of the latter. The old Sumerian language, however, seems not then to have become "dead," being preserved by the colleges of priests for religious use; and foreign languages were learned from foreigners. These were inscribed in vertical columns, on clay tablets; they have been found in the great library of Asurbanipal (Sardanapalus — 668–626 B.C.), at Nineveh, the source of our chief knowledge of Mesopotamian culture. Much the same sort of syllabaries seem to have been used by the Chinese and Japanese.

The ancestry of our own dictionaries, however, is Greek. Here we observe the usual progression from the special to the general. The typical modern dictionary is a complete or representative vocabulary of a language, present and historical, with definitions in its own or some foreign tongue; its object being to interpret either the meaning of the foreign tongue or the bygone part of its own, or the usages and history of the latter. But neither of these was thought of by the ancients. The small upper and priestly class settled their own usages of language, there was no half-educated reading populace relying on books for correct form, there was no foreign literature they cared to read, and foreign conversation they learned from conversation. Their first dictionaries were the same as our special vocabularies. The oldest surviving one, by Apollonius of Alexandria in Augustus' time, was a glossary of Homer's words — probably the oldest of all kinds if we had them, Homer being the common textbook of Greece; others were of ambiguous, corrupt, barbarous, foreign or dialectic phrases in the tragic and comic poets — phrases Attic, Lacedæmonian, Cretan, Rhodian, Italian, Phrygian, etc.; others of technical terms in cookery, a fascinating subject to the Greeks; others of drinking vessels, of the cries of animals, of synonyms, etc. Besides glossaries of Homer, there were others of Plato, the Ten Attic Orators, Hippocrates, etc. All of these, so far as preserved — unhappily, very few of them are preserved, and Athenæus in the 2d century gives the names of 35 lost to us — are of priceless value both for words and antiquities. On a larger scale were the Onomasticon ("word-book") of Julius Pollux, arranged topically in 10 books, which has survived; and a great lexicon, now lost, written by Helladius of Alexandria about 400 B.C. Of others may be noted an etymological dictionary by Orion of Thebes about 450, the first we have — for Varro's essays in Roman etymology can hardly be called a dictionary; a dialectic and local one by Hesychius of Alexandria, in the 4th century; and one of words similar in sound, but unlike in meaning, by Ammonius of Alexandria. Coming down to the Middle Ages, the most famous is that of Suidas, of unknown date or place, but probably about the 10th century; it is a slovenly compilation of words, names and places, but extremely valuable from its matter, not to be had elsewhere. Overleaping some centuries and their works, we come in 1572 to the mightiest of all, the tremendous 'Thesaurus Græcæ Linguæ' of the famous French scholar and printer, Henri Estienne or Stephanus (q.v.), Geneva, 4 vols., folio, a work gigantic not only in size but in scholarship; it was last reprinted by Didot at Paris, 1831–65, ed. Dindorf, 9 vols., folio, 9,902 pages. All the mediæval and modern lexicons till the 19th century were Greek into Latin; the first Greek-English one was not till 1814, by John Pickering, and that was not finished; the first complete one was by John Jones, 1823, London. For many years the only general one on the market has been the Liddell & Scott, revised by Drisler, in its various editions. This, however, is confined to classic and early-empire forms, to common nouns and to book words; and leaves need for several additional words. Later and mediæval Greek has been admirably covered by the lexicon of E. A. Sophocles, revised 1887 by J. H. Thayer; and a three-volume lexicon entirely devoted to the vast wealth of forms furnished by the inscriptions in progress. There is one of modern Greek by Contopoulos, Athens 1889; and there are special glossaries of the New Testament and of various great authors, English-Greek, Yonge, revised by Drisler, latest edition 1893.

Less needful are details of Latin dictionaries, though they have been very plentiful; in the Middle Ages they were the daily necessity of all cultivated existence. They began much later than Greek: even the etymological treatise of the great M. Terentius Varro, Cicero's contemporary, preserved only in fragments, can hardly be called a dictionary; the first real one is of Verrius Flaccus under Augustus. One of Guttenberg's volumes was the 'Catholicon' or 'Summa' of Johannes de Janua (Giovanni Balbi), 1460. The monk Calepino published in 1502 at Reggio a Latin-Greek lexicon, which was so famous that for many years all dictionaries were called "calepinos"; in 1575 it was made a polyglot of Italian, French and Spanish as well, and in 1590 extended to all languages, and many times reprinted. Robert Estienne, father of Henri published in 1531 at Paris a great 'Thesaurus Linguæ Latinæ,' not supplanted till Forcellini's 'Totius Lexicon Latinitatis' in 1771, at Padua. All these were Latin into Latin, except that the latter had definitions also in Greek and Italian. A new edition, largely supplemented, Prato, 1858–79, forms the greatest Latin dictionary ever published. The first Latin-English dictionary was the 'Promptorium Parvulum' of a Norfolk monk, Galfridus Grammaticus, compiled 1440, printed 1499; the first important one was by Sir Thomas Elyot, London 1538. In the 18th century Robert Ainsworth's was for many years the only popular one (London 1736). At present the two general popular ones are White & Riddle's (London 1880), and Harper's (Andrews Freund, revised by Lewis and Short, 1886). The great German-Latin one is Georges', 4 vols., Leipzig, 1880–85. The English-Latin are Smith & Hall, 1890; White & Riddle, 1869. A giant 'Thesaurus' was started in Leipzig, 1900, to outrank any other Latin lexicon in existence; it is to be edited by the greatest German scholars, under the supervision of the five great German academies, and has not yet finished the

letter A. The great dictionary of mediæval Latin is Du Cange's, 1733–36, re-edited, Paris 1882–88, 7 vols.

For modern European languages into English and vice-versa, the following are standard: French — Smith, Hamilton & Legros, 1891; Spiers & Surenne 1891; Gasc, 1895. German — Thieme-Preusser, 1898; Flügel, 1891; Lucas, 1854–68; Whitney, 1877, valuable for etymology; Adler's, 1875, still unequaled for discrimination of synonyms. Spanish — Velazquez, revised by Gray and Iribas, 1901 (the old Velazquez's Seoane revised with a great new technical vocabulary). Portuguese — Lacerda, 1871; Michaelis, 1894; Valdez, 1879. Italian — Baretti, 1877; Meadows, 1869; James and Grassi, 1884; Millhouse, 1899. Dutch — Calisch, 1890. Danish — Ferrall, Repp & Rosing, 1873. Swedish — Wenström & Lindgren, 1889; Nilsson, Widmark & Bollin, 1889. Norwegian — Geelmuyden, 1886. Russian — Alexandrov, 1879. Turkish — Redhouse, 1880. Polish — Baranowski, 1884. Hungarian — Bizonfy, 1878–86.

The great foreign dictionaries of their own languages, corresponding to the 'Century Dictionary' or the 'New English Dictionary' of our own, are: French — Littré's, 4 vols., 1863–72, supplement, 1878–82. Larousse's rich work is an encyclopædia. German — Jacob and Wilhelm Grimm, etc., the first volume published 1854, and the work is still unfinished. The brothers Grimm died 1859–63, and a succession of scholars have carried it on, but the parts appear slowly. Italian — Tommaseo and Bellini, four volumes in eight, 1861–79. Castilian Spanish — Dictionary of the Spanish Academy; Donadiu and Puignau, 1890–95; Cuervo's unfinished work, 1866–94. There is also a two-volume dictionary of Catalan, by Lobernia and Esteller. There are of course many other smaller but valuable etymological and historical dictionaries. Of other languages may be mentioned: Portuguese — Caldas Aulete, 1881. Provençal into French — Mistral, 1886. Sardinian into Italian, and vice versa, Spano, 1851. Dutch — Dale, 1885–89; Franck, 1884–92. Swedish — Kalkar, unfinished. Icelandic — Cleasby and Vigfusson, 1874. Welsh — Evans, 1887, unfinished. Irish — Foley, 1855; O'Reilly, supplement by O'Donovan, 1864; Dinneen, 1904. Russian — Dahl, 1862–73. Polish — Rykaczewski, 1866. Slavonian — Miklosich, 1886. Turkish into Arabian and Persian, Zenker, 1866–76. Chinese into Latin, De Guignes, 1877; into French and Latin, 1869. Annamese — Pauthier, in Chinese characters with pronunciation in Chinese and Annamese.

Though Oriental and ancient, their close connection with our racial and religious ancestry and current problems makes Sanskrit and Hebrew worth noting separately. For the former, the great English works are by Monier-Williams: English-Sanskrit, 1851; Sanskrit-English, 1872. Hebrew, Fürst, 1867.

English lexicography, on its own language begins very humbly, with John Bullokar's 'English Expositor,' 1616. More famous was Henry Cockeram's, 1623, which passed through nine editions up to 1650. Blount (1656), Philips (1658) and Coles (1677) succeeded these; but the first attempt at a thorough collection was Nathan Bailey's (1721). This gave etymologies, marked accents, and remained the sole possessor of the field till Johnson's appeared in 1755; and was reprinted over a quarter of a century longer from its handy size, the 24th edition dating 1782. Johnson's, however, is the first of any importance from a scholar's point of view. The etymologies are superseded, but he was the first to make a dictionary something like a history of the language, with full (even over-full) illustrative examples, precise definitions, and attention to the form. It has been reprinted as late as 1866, but for popular use is superseded even in England by the great American dictionaries, and for scholars by special works. It did not mark pronunciation except by accents, likely Bailey's. The first to enter on this unending task was Kenrick (1773); then came Perry (Boston 1777); Thomas Sheridan (1780), the elocutionist, father of the great dramatist; Walker (1791), of immense vogue in its time and still cited as an authority, though entirely out of date; Smart (1836), based on Walker; all making their first claim as arbiters of elegant taste. Richardson (1836) was primarily for etymologies. Ogilvie's 'Imperial Dictionary' (1850, new ed. 1883) was the first of the great encyclopædic dictionaries; the 'Century Dictionary' was at first intended only as a slightly revised reprint of Ogilvie, but swelled into the magnificent work so well known. Previously, another English work of the sort had appeared, Hunter's, 1879–88. But the one monumental English dictionary is to be the 'New English Dictionary on Historical Principles,' edited by James A. H. Murray and Henry Bradley, greatly assisted by the late Fitzedward Hall, from matter collected by the Philological Society. It has reached the letter U at this writing, and will take several years to complete; and will form an absolute history of all English words and meanings from 1200 A.D. to date. Noah Webster's first dictionary was in 1806, but the first edition of his epoch-making 'American Dictionary' was in 1828. This has become the 'Webster's International Dictionary' of 1890; always connected with Yale College scholarship, through Webster's son-in-law Chauncey A. Goodrich, and later through Noah Porter. Webster was the founder of American lexicography, and by his enthusiasms and original ideas has left a permanent impress on American usages, even where his pet notions have been discarded. His work brought out its chief rival for many years, 'Worcester's Dictionary' (1860), by a scholar who had assisted him but disliked his innovations, and wished to substitute elegant usage for what he thought Webster's barbarisms. It had great influence for a generation, and has a tenacious tradition yet. The 'Standard Dictionary' (1893–95) is a medium between the compression of Webster and the encyclopædic magnitude of the 'Century.'

Among special dictionaries may be named Jamieson's 'Etymological Dictionary of the Scottish Language,' 4 vols., 1879–82, with a supplement 1887; Wilson's 'Glossary of British India,' 1851 and Yule & Burnell's 'Anglo-Indian Words and Phrases,' 1886; Wright's 'English Dialect Dictionary,' about half finished; Bradley's 'Middle English Dictionary,' 1891; Taylor's 'Words and Places,' several revisions, and Blackie's 'Dictionary of Place-Names,' both etymologies of names; Bartlett's 'Dictionary of Americanisms' (1877), much too inclusive, and

Farmer's 'Americanisms, Old and New' (1899); Roget's 'Thesaurus' of Synonyms, last edition 1892; Sturgis, 'Dictionary of Architecture and Building' (3 vols., 1902); Cheyne & Black, 'Encyclopædia Biblica' (4 vols., 1900–03); Stephen and Lee, 'Dictionary of National Biography' (66 vols., 1885–1901)—a new edition of this monumental work was published in 22 volumes (1909–09); Adams, 'Dictionary of American Authors' (New York, 1898; 5th ed., revised and enlarged, ib., 1905); 'Who's Who'; 'Who's who in America'; in German, 'Wer Ist's' (these last three are revised annually); Watts, Dictionary of Chemistry' (1888–94); Thorpe, 'Dictionary of Applied Chemistry' (1912–13); Wright, 'The English Dialect Dictionary' (1898–1905); Haydn, 'Dictionary of Races and Peoples' (Washington 1907); Gould, 'Illustrated Dictionary of Medicine' (6th ed., New York 1910); Elson, 'A Dictionary of Music' (Boston 1905); Grove, 'Dictionary of Music' (5 vols., 1904–10); Harbottle and Dalbiac, 'Dictionary of French and Italian Quotations' (London 1904); Cheyne and Black, 'Encyclopedia Biblica' (New York 1899); McClintock, J., and Strong, J., 'Cyclopædia of Biblical, Theological and Ecclesiastical Literature' (11 vols., New York 1895); Gillow, Joseph, 'Bibliographical Dictionary of the English Catholics' (5 vols., London 1885); Hastings, 'Encyclopædia of Religion and Ethics' (10 vols., New York 1908); Blunt, J. H., 'Dictionary of Sects, Heresies, Ecclesiastical Parties and Schools of Religious Thought' (London 1892); 'Encyclopædia of Superstitions, Folklore and the Occult Sciences of the World' (3 vols., Chicago 1903); Smith and Cheetham, 'Dictionary of Christian Antiquities' (2 vols., London 1875); Piercy, W. C. (ed.), 'Murray's Illustrated Bible Dictionary' (London 1908); Julian, J., 'Dictionary of Hymnology' (London 1907); 'New Schaff-Herzog Encyclopedia of Religious Knowledge' (12 vols., New York 1908); Hastings, 'Dictionary of the Bible' (5 vols., New York 1899); Wright, C. H. H. and Neil, C., 'A Protestant Dictionary' (London 1904).

DICTOGRAPH, a species of telephone with a sensitive granular carbon transmitter and a large diaphragm which increases the reproduction of the sound at the receiving end. This instrument has in recent years figured in many trials. The transmitter is placed inconspicuously behind a picture frame or other object which effectually conceals it, in a room where suspected persons hold conferences. Wires lead to a recording station, where the spoken words are taken down by a stenographer. A variety of the instruments has been installed in the waiting rooms of railroad stations, the announcer speaks into the transmitter and his voice is repeated by several loud-speaking receivers located in different parts of the room. See TELEPHONE.

DICTUM, an expression of opinion by a court on some point not involved in the case under discussion. When the court decision is made some statement which has little to do with the case is often found in the middle of the argument on which it either sheds some light or is allied to it or illustrates the cause in some way. Such expressions are frequently quoted for the judge's opinion on the case and have caused considerable confusion in this way. They are also repeated as binding upon a point which was not involved in the case. When taken by themselves and in their proper relation to the court decision on the real point involved, they are often of great importance and are useful in formulating and grounding other opinions.

DICTUM OF KENILWORTH, the agreement entered into during the siege of Kenilworth in 1266 by Henry III and the rebellious barons.

DICTYNIDÆ, a family of spiders which weave irregular webs from two kinds of silk. See SPIDER.

DICTYONEMA, genus of fossil graptolites found from the upper Cambrian to the Carboniferous, in the Baltic Provinces, England, Scandinavia, Eastern Canada and New York. The colony, when found pressed out on the surface of a slab, appears as a network of fine filaments radiating from a common base and united at several points by horizontal threads. See GRAPTOLITE.

DICTYOTALES, a group of marine algæ. Their combination of characters is very remarkable, there being present the tetraspores of the red algæ, a brown pigment characteristic of the brown algæ and sperms proper to themselves. They are generally classed as an offshoot of the red algæ.

DICTYS, dĭk'tĭs, **OF CRETE,** a follower of Idomeneus in the Trojan war, whose name is attached to a professed journal of the leading events of the contest, which has come down to us in Latin prose, under the title 'Ephemeris Belli Trojani.' An introduction relates how the narrative, inscribed in Phœnician characters on bark-paper, was found in a coffer of tin in Dictys' tomb, which had been burst open by an earthquake in the reign of Nero, and how the emperor caused it to be translated into Greek; this is accompanied by a letter from one Quintus Septimius, who claims to have prepared the condensed Latin version that follows. Grenfell and Hunt discovered a fragment of the papyrus in 1904–05. It was published in 1907 in the Tebtunis Papyrit (Book II). This dates probably from the 4th century A.D., and though of no intrinsic value, was a chief source of the romances of the Middle Ages. The best editions are those of Dederich (Bonn. 1832 and 1837) and Meister (Leipzig 1872).

DICYCLIC PLANTS. See BIENNIALS.

DICYNODON, a genus of fossil reptiles classified with the Anomodonts, or Anomalous-toothed reptiles. Their remains, usually only the skull, occur in a sandstone, supposed to be of Triassic age, in southern Africa and India, and in the Elgin sandstone of Scotland. The bones of the head indicate a distinct type between the lizards and turtles though with some characteristics of the crocodile, but they had two nasal apertures instead of the single one possessed by these other reptiles. The anterior portions of the jaws appear to have been altogether toothless and they form a kind of beak, which was probably sheathed in horn. The lower jaw has no teeth, but each superior maxilla carries an enormous tusk-like canine tooth similar to the tusk of a walrus, growing from a persistent pulp. The eye orbits were

very large and the cranium flat. They were mostly small, the largest skull found being but 20 inches long. The usual size is about six inches long. They were evidently amphibians, and air breathers.

DIDACHE, dĭd'ą-kē, (Gr. *διδαχὴ τῶν δώδικα 'αποστόλον,* the teaching of the twelve apostles), an ancient Christian work, in Greek, of between 120 and 150 A.D. It was found in 1873 by Bryennios, Archbishop of Nicomedia, in the monastery of the Holy Sepulchre, Constantinople. The manuscript was of the 11th century. It contains a description of the two ways of life or death, giving rules for Christian conduct. A second part gives directions concerning the observance of the rites of baptism and the Eucharist and their administration, states the duties of apostles, teachers, bishops, etc. The work was held in great esteem in the early church, being quoted as Scripture by some of the Fathers. Most critics are inclined to attribute it to Syria or Egypt and include it among the Apostolic Fathers. The work is of very great value for its information regarding the belief, worship and organization of the primitive Christian church. The text, with critical commentary, is found in Funk, 'Patres Apostolici' (2d ed., Tübingen 1901). Consult Cruttwell, T. C., 'Literary History of Early Christianity' (2 vols., 1889); Harris, J. R., 'The Teaching of the Apostles' (Baltimore 1887, containing a facsimile of the manuscript); Kirsopp Lake, 'Apostolic Fathers' (in 'Loeb Classical Library,' New York 1912); Krüger, 'History of Early Christian Literature' (ib. 1897); Schaff, Philip, 'The Teaching of the Twelve Apostles' (3d ed., ib. 1889).

DIDACTIC POETRY (from Gr. *διδακτικός,* pertaining to teaching), has as its object the instruction of the ignorant. In the early ages of Greek literature there was no prose writing. Hesiod taught husbandry and theology in verse, Solon harangued in hexameters. Ever since that time verse has to some extent been used as a vehicle of teaching. The early Ionian philosophers, like Xenophanes, expounded their system in poetry, and, in the later days of the Roman republic, Lucretius, in the finest didactic poem that was ever written, unfolded the theories of Epicurean materialism. Virgil wrote the 'Georgics' to teach the veterans of Augustus the art of agriculture, and Horace in his 'Art of Poetry' embodied for young Roman poets the Greek principles of dramatic writing, while Ovid set forth systematically the 'Art of Love.' Vida, the Italian, Boileau, the Frenchman, Pope, the Englishman, also wrote in verse an 'Art of Poetry.' English poets have been much inclined to didactic poetry. Darwin's 'Botanical Garden' is a treatise on the Linnæan systems of botany. The longer poems of Cowper are moral lectures. Dyer's 'Fleece' is the shepherd's guide, and even the 'Shipwreck of Falconer' may be looked upon as a manual of seamanship.

DIDELPHIA, a group of mammals comprising the Marsupials (q.v.), so called in reference to the double condition of the generative organs in the female. Compare Monodelphia, and see Metatheria.

DIDEROT, Denis, dēd'rō', French man of letters and encyclopedist: b. Langres, 5 Oct. 1713; d. Paris, 31 July 1784. He was educated by the Jesuits but afterward became one of the bitterest enemies of the church. When his education was at an end he became estranged from his family by turning away from respectable callings and engaging in the Bohemian life of a bookseller's hack in Paris. In 1743 he married Anne Toinette Champion, a devout Catholic, but possessed of a narrow and fretful temper; in consequence Diderot's domestic life was unhappy. He sought attachments abroad, first with a Madame de Puiseux, who prompted his indecent novel, 'Les Bijoux indiscrets' (1748), and later with Sophie Voland, to whom he was constant throughout her life. In 1743 he published a translation of Stanyan's 'History of Greece,' and three years later a translation of James' 'Dictionary of Medicine.' In 1746 he published his first independent work, the 'Pensées philosophiques,' a general statement of the usual rationalistic objections to a supernatural religion. It was followed in 1747 by the 'Promenade du sceptique.' The first work which brought him into general notice was his famous 'Lettre sur les aveugles à l'usage de ceux qui voient' (1749), a study of the philosophy of sensation, involving also an undermining of ethical standards and of social order. It contains strange forecasts of later discoveries and hypotheses, such as the survival by superior adaptation and the suggestion of teaching the blind to read through the sense of touch. The publication of the work caused the imprisonment of Diderot at Vincennes, where he remained three months; then he was released to enter on the gigantic undertaking of his life. Lebreton, the bookseller, had projected a French translation of Chambers' 'Encyclopædia' and approached Diderot in regard to the undertaking. Diderot persuaded the publisher to enter upon a new work which should collect under one roof all the active writers, all the new ideas, all the new knowledge, that were then stirring the cultivated strata of society. The 'Encyclopédie' thus became the organ of intellectual emancipation rather than of any single school of ethics or philosophy. D'Alembert was appointed Diderot's colleague and so remained until 1759. Diderot spent 20 years of unremitting toil on the work, revising, editing, correcting and combating the intrigues of opponents. He wrote all the articles on technology and industries, besides many of those on points of philosophy and even on physics and chemistry. The first volume appeared in 1751 and the last in 1772. The work fell under the ban of the censors in 1759, but owing to the venality and corruption of the authorities the work went on as before, excepting the defection of Turgot and D'Alembert. The work was not primarily revolutionary, but practical. It takes for granted the justice of religious tolerance and speculative freedom. It asserts the democratic doctrine that it is the common people in a nation whose lot ought to be the main concern of the nation's government. The entire work is one unbroken process of exaltation of scientific knowledge on the one hand and pacific industry on the other. Despite this arduous task Diderot gave further proof of his versatility in the admirable reports on the annual exhibitions of painting, by which he established the first bond between art and literature. He wrote two dramas—'Le fils Naturel' (1757) and 'Le père de famille' (1758), which mark

the beginning of modern domestic drama. His 'Paradoxe sur le comédien' influenced Lessing and the German stage, and Goethe translated an essay on painting from the 'Encyclopédie.' His novel, 'The Nun,' and the dramatic dialogue, 'Le neveu de Rameau,' are wonderfully effective pictures of the corrupt society of the time. His little sketches are pearls of kindly humor and of witty narrative. It is calculated that the average annual salary received by Diderot for his work on the 'Encyclopédie' was but $600 per year. In 1773 he felt obliged to sell his library to provide a dowry for his daughter. It was purchased by Catharine II of Russia and presented to Diderot whom she constituted her salaried librarian. Diderot went to Russia to thank the empress and spent some months in her society in Petrograd. He returned home in 1774 and passed his remaining years in the acquisition of new knowledge, in ephemeral compositions and in luminous conversations with his friends, who deemed him unrivaled as a conversationalist. The justice of their opinion is borne out by the fact that his influence on his contemporaries was tremendous. His works were edited by Assezat and Tourneux (20 vols., Paris 1879). His 'Correspondance' with Sophie Voland gives perhaps the best insight into his character. Consult Brunetière, 'Études critiques' (Paris 1881); Carlyle, 'Essay on Diderot' (London 1881); Collignon, A., 'Diderot' (Paris 1907); Cru, R. L., 'Diderot as a Disciple of English Thought' (New York 1913); Lauson, G., 'Histoire de la Littérature française' (Paris 1912); Morley, John, 'Diderot and the Encyclopædists' (London 1891), the best study in English of Diderot's life and influence; Rosenkranz, 'Diderot's Leben und Werke' (Leipzig 1866); Tornézy, A., 'Le légende des philosophes' (Paris 1911).

DIDIER, dē-dyā, or **DESIDERIUS,** the last king of the Lombards. He was Duke of Istria, and happening to be in Tuscany in 756, when Astolphus, the previous king, died childless, immediately raised an army and laid claim to the throne. Didier was crowned and seemed to have secured the permanence of his dynasty by marrying his daughter to Charlemagne in 770. The marriage, however, proved unfortunate; and when Charlemagne dissolved it by repudiation, the quarrel between the families became irreconcilable. Didier afterward invaded the Papal States and made a conquest of a part of them, when Charlemagne interfered. Didier, unable to oppose him, shut himself up in Pavia, when, after a siege of a year, he was obliged to surrender at discretion.

DIDIER, Charles, French poet and novelist: b. Geneva 1805; d. Paris, 8 March 1864. He wrote some novels designed to awaken patriotic sentiment in Italy and to make known the struggles of the Carbonari and other revolutionists against Austrian and papal dominion. Among these were 'Underground Rome' (1833); 'The Roman Campagna' (1842); and 'Fifty Years in the Wilderness' (1857). His lyric poems, 'Melodies' (1827), are characterized less by force than by sweetness.

DIDIER, Jules, French painter: b. Paris, 26 May 1831; d. 1892. He studied under Cogniet and Laurens, and won the Prix de Rome in 1857. He confined himself almost exclusively to rustic scenes, landscapes and animals. Among his works are 'Farm on the Ruins of Ostia' in the Luxembourg; 'Normandy Landscape'; 'Hunting a Hare'; 'Morning on the Borders of the Wood'; 'Agriculture'; 'Ford near Autun'; and 'Return of the Drove'; 'Banks of Lake Trasimene' (1863); 'View in the Forest of Compiègne.' He also executed some beautiful lithographs.

DIDION, dē'dyōn', **Isidore,** French soldier and author: b. Diedenhofen 1788; d. 1878. He received his education at the École Polytechnique and the Metz Academy. In 1848 he was appointed head of the percussion-cap manufactory of the French government at Paris and 10 years later was made general of brigade. He was an authority on the science of projectiles; his works on this subject including 'Traité de balistique' (1848; 2d ed., 1860); 'Cours élémentaire de balistique' (1854; 3d ed., 1859); 'Progrès des sciences et de l'industrie' (1875).

DIDIUS SALVIUS JULIANUS, Marcus, Roman emperor: b. about 133 A.D.; d. Rome, 1 June 193 A.D. Having filled the offices of quæstor, ædile and prætor, he was appointed commander of a legion in Germany, and subsequently governor of Belgica. Having distinguished himself in Africa and Asia Minor, he returned to Rome, and, on the assassination of Pertinax, made himself emperor by bribing the prætorian guards. He now assumed the name of Marcus Didius Commodus Severus Julianus; but after a short reign of two months was killed in his palace by a common soldier.

DIDO, queen of Carthage. She was the daughter of Agenor (Belus); according to others, of Carchedon of Tyre, from whom Carthage received its name; others call her father Mutgo or Muttinus. Her brother was Pygmalion, king of Tyre. Her father married her to her uncle Acerbas, otherwise called Sichæus or Sicharbas. He was murdered before the altar by her brother, who was instigated by the desire of making himself master of his wealth. She therefore set sail for Africa, with all her wealth and her faithful companions. They landed on the coast of Africa, not far from Utica, a Tyrian colony. She purchased as much land as might be covered with the hide of a bull, which she cut into the thinnest possible strips, and surrounded with it a large extent of territory. Here she first built the citadel of Byrsa, and afterward Carthage. Hiarbas, a neighboring prince, paid his addresses to her. Unwilling to accept and unable to refuse the proposal, she sacrificed her life on the funeral pile. By an anachronism common with poets, Virgil attributes her death to the faithlessness of Æneas. Dido was worshipped in Carthage as a goddess.

DIDON, dē'dōn, **J. Henri, Père,** French Dominican preacher and writer: b. Touvet, Isère, 17 March 1840; d. 1900. He entered the Dominican Order in 1858, and attracted much attention for his series of eloquent Lenten sermons. Having come into conflict with his superiors because of his views about democracy, he ceased for a time to preach and resided at Corbara, Corsica. His leisure was spent in preparing a life of Jesus, which should be an antidote to the skeptical 'Vie de Jésus' of Renan. This was published in 1891 under the title

'Jésus Christ,' a book which made a great impression throughout France. He has also written 'Les Allemands' (1884). His last years were spent in the education of youth at the École Albert-le-Grand at Arceuil, near Paris, of which he became director.

DIDONCEPHALUS, a monster with a double range of teeth, or a double jaw.

DIDOT, dē'dō', **Ambroise Firmin,** French publisher: b. Paris, 7 Dec. 1790; d. there, 22 Feb. 1876. He was a son of Firmin Didot (q.v.) and with his brother Hyacinthe published such important works as 'L'Univers pittoresque'; 'Nouvelle biographie générale,' etc. He traveled much in the Orient and studied Greek. He began the 'Bibliothèque des auteurs grecs' and also reprinted Du Cange's 'Glossarium mediæ et infimæ latinitatis.' In 1872 he was elected member of the Academy of Inscriptions and Belles Lettres.

DIDOT, Firmin, French publisher, printer and type-founder: b. Paris, 14 April 1764; d. 24 April 1836. He was a brother of Pierre Didot (q.v.). He was inventor of a new sort of script, and an improver of stereotype printing. In 1811 he was printer to the Institut and from 1827 till his death represented Nogent-le-Retrom in the Chamber. He translated Tyrtæus and Theocritus and the 'Bucolics' of Virgil. After 1811 he had as partners his sons, Ambroise and Hyacinthe.

DIDOT, François, frän-swä, French printer: b. Paris 1689; d. 2 Nov. 1757. He founded the famous firm of Didot in Paris in 1713. His sign read «A la Bible d'Or.» He it was who published the works of Abbé Prevost.

DIDOT, François Ambroise, French printer: b. Paris, 7 Jan. 1730; d. 10 July 1804. He was a son of François Didot (q.v.), and invented many of the machines and instruments now commonly used in the typographic art. From his foundry came the most beautiful types, that, up to that period, had been used in France, and he was the first person in France who printed on vellum paper. He took the greatest care to have his editions correct. By the direction of Louis XVI he printed a collection of the French classics for the use of the Dauphin. The Count d'Artois employed him to print a similar collection, the 'Collection de divers ouvrages français imprimée par ordre du Comte d'Artois' (64 vols.)

DIDOT, Henri, French type-founder: b. 1765; d. 1852. He was a son of P. F. Didot (q.v.), and early distinguished himself as a type-engraver. He then applied himself particularly to improve the method of founding types, in which he succeeded by the invention of a new founding apparatus. He called his process «fonderie polyamatype.» It is more expeditious than the former mode, and the types are much cheaper.

DIDOT, Hyacinthe Firmin, French publisher: b. Paris, 11 March 1794; d. Dandon, France, 7 Aug. 1880. He was a son of Firmin Didot (q.v.), and with his brother, A. F. Didot, conducted the business of the house of Didot from 1827.

DIDOT, Pierre, French publisher and printer: b. 25 Jan. 1761; d. 31 Dec. 1853. He was a son of François Ambrose Didot (q.v.), and succeeded his father in the printing business in 1789. In the universal impulse which the arts received from the Revolution he aimed at becoming the Bodoni of France, and conceived the plan of a splendid edition of the classic authors in folio, which should excel, if possible, the best editions extant. He spared no expense to adorn them with all the splendor and elegance of the arts of design, and even sacrificed a part of his property to this favorite object. His 'Virgil' (1798) was worthy of these endeavors, and still more so his 'Racine' of 1801, which the French regard as the first typographical production of any age or country. Only 250 copies of these works were struck off. Among the productions of his press, Visconti's 'Iconographie' is particularly distinguished. Didot devoted the efforts of 10 years to the improvement of the types, and caused 18 different sorts, with new proportions, to be cut, with which he printed Boileau and the 'Henriade' in 1819. Didot paid no less attention to correctness and purity of text, and perfect consistency of orthography, than to typographical beauty. Consult Piper, Alfred Cecil, 'Some Great Printers and their Work: the Didots' (in *Library World,* London 1914), and Werdet, E., 'Études biographiques, sur la famille des Didot' (Paris 1864).

DIDOT, Pierre-François, French printer: b. Paris, 9 July 1732; d. 7 Dec. 1795. He was a son of François Didot (q.v.), and distinguished himself by his bibliographical knowledge. He also became printer to Louis XVI. He had a great share in the changes made in the character of types, and contributed to the advancement of his art. He published some very fine editions; among them the 'Voyages d'Anacharsis.'

DIDRON, dē'drōn', **Adolphe Napoléon,** French archæologist: b. Hautvilliers, Marne, 13 March 1806; d. 13 Nov. 1867. He was advised by Victor Hugo to undertake the study of Christian archæology. He traveled in Greece, Germany, Italy, England and France, everywhere studying ecclesiastical remains. He began in 1844 to publish 'Annales Archéologiques,' devoted to mediæval art and antiquities, which he continued to 27 volumes. This work was completed, long after his death, by the 28th volume, which included a general index. It is a valuable storehouse of mediæval art and archæology. His chief works are a 'Manual of Christian Iconography,' translated from an ancient manuscript, and 'Christian Iconography' (1843), which forms a history of the representations of the persons of the Trinity in art, their attributes, etc.

DIDSBURY COLLEGE, a Wesleyan theological institution situated near Manchester, England. It was founded in 1842, from funds collected in 1839 during the commemoration of the centenary of Methodism. It has a high reputation for scholarship, having numbered among its faculty such men as W. B. Pope, the theologian, and Professor Geden, the great biblical scholar.

DIDUNCULUS, a genus of birds allied to the pigeons, and comprising only the one species, *D. strigirostris* of the Navigator Islands. This bird is of special interest as being the nearest living ally of the extinct dodo. It has a length of about 14 inches, with a glossy plumage verging from a velvety black on the back to greenish black on the head, breast and abdomen. The

large beak, which is nearly as long as the head, is greatly arched on the upper half, while the lower is furnished with two or three tooth-like indentations. See PIGEON.

DIDYNA. See BRANCHIDÆ.

DIDYMÆUS, dĭd-i-mē'ŭs, a surname of Apollo, either because he was the twin-brother of Diana, or from the double light of the sun and moon, which he lends to men. Under this name Apollo had one of the most famous of his temples and an oracle at Didyma among the Milesians. Pindar calls Diana Didyma.

DIDYMIUM (Gr. "twin"), a supposed metallic element, isolated from the mineral cerite by Mosander in 1842. The symbol D or Di was assigned to it, and its atomic weight was considered to be about 143. The name referred to the close resemblance between the new metal and the element lanthanum, which had been discovered by the same chemist, and in the same mineral, a short time before. Recent researches have shown that didymium is not an elementary body, but that it consists principally of two other elements, which are respectively known as neodymium and praseodymium (q.v.). This discovery renders the name "didymium" singularly appropriate for the original substance.

DIDYMOGRAPTUS, a genus of graptolites, consisting of about 40 species, found abundantly in the graptolite shales of the lower and middle Ordovician in Europe, America and Australia. For structure, forms, etc., see GRAPTOLITE.

DIDYMUS, Alexandrian grammarian and critic: b. 63 B.C. He was a prolific writer. He belonged to the school of Aristarchus, and was contemporaneous with Cicero. By Seneca his works were estimated at 4,000; none now extant. Fragments have been published by Schmitt (Leipzig 1854).

DIDYMUS OF ALEXANDRIA, ecclesiastical writer: b. 309; d. 394. He became blind when four years old, but nevertheless succeeded in acquiring all the sciences as then known. Athanasius appointed him director of the Theological School of Alexandria. Nearly all of his writings are lost. Jerome, who was one of his pupils, has left a translation of Didymus' treatise on the Holy Spirit, and there is extant a translation by Epiphanius of his comments on the canonical Epistles. Other extant works, in Greek, are a treatise on the Trinity and one against the Manichæans. These are contained in Migne 'Patrologia Græca' (Vol. XXXIX).

DIDYMUS, Greek translation of the Hebrew, *t'ōm* (Aramaic *tō' mā'*), a twin, of which Θῶμας, *Thomas*, is a transliteration. It was the alternative name of one of the disciples of Jesus (John xi, 16; xx, 24). His first name being Judas, the alternative is given to distinguish him from Judas Iscariot.

DIE (*Dea Vocontiorum*), the capital of an arrondissement in the department of Drôme, southeastern France, is situated on the right bank of the Drôme, at the foot of Mount Glandaz, in a wide and fertile plain. The manufactures are woolen cloth, paper, leather and silk; there is some trade in cattle and timber, and the neighborhood produces excellent fruit, and the white wine called "Clairette de Die." The town was formerly the seat of a bishop, and previous to the revocation of the Edict of Nantes in 1685, of a Calvinistic university. Among the interesting structures of Die are the old cathedral with granite columns from an ancient temple of Cybele, and a porch of the 11th century; the episcopal palace, the walls flanked by towers; and the ruins of a castle — all of considerable age; the triumphal arch on the road toward Gap, known as the Porte Saint Marcel, portions of an aqueduct, and other Roman remains. There are several mineral springs in the vicinity. Pop. 4,000.

DIE ELIXIERE DES TEUFELS. The Devil's Elixir (by T. A. Hoffmann, 1816); has held for a century a leading place among the shudder-tales of diabolism. In a cloister is preserved among the relics a bottle once left by the devil in the cell of Saint Anthony. Whoever tastes its contents becomes possessed by Satan. Brother Medardus, to keep his imperiled fame as a preacher, drinks, and gains an intense new life for evil. Haunted by a terrible unknown presence, protected from the consequences of his crimes by his "double," a crazy Capuchin, who takes the punishments, he runs a wild course of successful criminality as hunter, gambler, and so on, with intervals of self-revealing terrors that border on insanity, and every device of literary fancy to make the naive reader's blood run cold. At last the ex-monk and libertine returns, after long and gruesome penance, to his cloister and, after a weird phantasmagoria of ghost-walking and witches' sabbath, attains an edifying death. The book is remarkable, even in comparison with Hoffmann's other tales of terror, for its exhaustless invention, the realistic illusion of its utter unreality, and its power to grip the imagination, while the author seems to smile with romantic irony at his own power. The fantastic humor of "Devil-Hoffmann" finds more congenial expression in 'Lebensansichten des Katers Murr.' An English translation of the 'Elixir' appeared in 1824, and has been followed by many others.

BENJAMIN W. WELLS.

DIEBITSCH-SABALKANSKI, dyi-bĕch-zä-bäl-kän-skē, **Hans Karl Friedrich Anton,** COUNT, Russian field-marshal: b. Grossleippe, Silesia, 13 May 1785; d. Kleczwo, near Polotsk, Poland, 10 June 1831. In 1797, when 12 years of age, he was sent by his father, who had served under Frederick the Great and Frederick William II of Prussia, to the military school of Berlin, but in 1801 he quitted the Prussian service for that of Russia, entering the ranks of the Imperial guard. He served with distinction in the battles of Austerlitz, in 1805; Eylau and Friedland in 1807, and, having attained the rank of captain, for five years subsequent to the treaty of Tilsit, devoted himself to the study of military science. During the invasion of the French in 1812, he served under Wittgenstein, compelled the capitulation of the Prussian general, Yorck, became chief of staff in 1813, took part in the battle of Lützen, and later joined the corps of Barclay de Tolly in Silesia, as quartermaster-general. In June 1813 he was instrumental in bringing about the secret treaty of Reichenbach, between England, Austria, Russia and Prussia. He fought in the battles of Dresden and Leipzig, and for his services was made lieutenant-general, at the age of 28, by Alexander. He was responsible for the march on Paris, in the

French campaign of 1814, which terminated the war, and for this he was decorated with the order of Alexander Nevskoi. He took command of the first corps upon Napoleon's return from Elba, but was later appointed adjutant to the emperor, and, having been made chief of staff, accompanied him on his journey through southern Russia, till his death at Taganrog, in 1825. Diebitsch thereupon returned to Saint Petersburg, and by his intrepid conduct during the revolution of 25 December, won for himself the title of baron, and later Emperor Nicholas created him count. He had the chief command in the Turkish War of 1828–29; stormed Varna; and made the famous passage of the Balkans, compelling the Porte to conclude the peace of Adrianople, for which the surname of Sabalkanski (Transbalkanian), was conferred upon him, and he was raised to the rank of field-marshal. He was appointed commander-in-chief of the army sent to put down the rebellion which had broken out in Warsaw, 29 Nov. 1830, and was also made governor of the provinces adjoining Poland. In this campaign he did not meet with success, suffering defeats at Wisniew and Stoczek, 11 Feb. 1831; at Dobre, on the 18th; at Grochow and Wawer on the 19th, and in the series of engagements fought near Praga, in March. He was, however, more successful in the bloody battles of Nur, Lornza and Ostrolenka, fought from 15–26 May, but after establishing his camp at Kleczwo, was taken sick with cholera, and died shortly afterward. Consult Belmont, 'Graf Diebitsch' (Dresden 1830); Chesney, 'Russo-Turkish Campaigns of 1828–29' (New York 1856).

DIEDENHOFEN, dē-dĕn-hōf'ĕn. See THIONVILLE.

DIEFENBACH, Lorenz, dēf'ĕn-baH, German philologist: b. Ostheim, Hesse, 29 July 1806; d. Frankfort-on-Main, 28 March 1883. He was 12 years pastor and librarian at Solms-Laubach. In 1848 he settled at Frankfort-on-Main, where in 1865 he was appointed second librarian to the city. His literary industry was enormous, embracing poetry and romances, as well as those more ponderous works by which his name will live. His greatest books are 'Celtica' (1839–40); 'Vergleichendes Wörterbuch der Gothischen Sprache' (1846–51); 'Glossarium Latino-Germanicum mediæ et infimæ ætatis,' a supplement to Ducange's well-known 'Glossary' (1857); 'Origines Europææ'; 'Hoch- und Niederdeutsches Wörterbuch' (with Wülcker, 2 vols., 1874–75).

DIEFFENBACH, Georg Christian, German poet and theologian: b. Schlitz, Hesse, 1822; d. 1901. He was educated at Giessen and was made chief pastor of his native place in 1871. His poems for children are still very popular in Germany. He also wrote many liturgical, devotional, homiletic and poetical works, which attained a great degree of popularity.

DIEFFENBACH, dēf'fĕn-bäH, **Johann Friedrich,** German surgeon: b. Königsberg, 1 Feb. 1794; d. Berlin, 11 Nov. 1847. He was educated in theology, but from 1813–15 served as a volunteer in the war against Napoleon. Upon his return he devoted himself to the study of medicine, taking his degree at Würzburg in 1822. He soon became widely known as an operator; in 1830 became head surgeon in a Berlin hospital; in 1832 became a professor in the university; and in 1840 director of clinical surgery. He was distinguished as an operator, especially in the art of forming by transplantation new noses and lips. He wrote 'Die Transfusion des Blutes und die Einspritzung der Arzneien in die Adern' (1828); 'Chirurgische Erfahrungen' (4 vols., 1829–35); 'Durchschneidung der Sehnen und Muskeln' (1841); 'Ueber das Schielen' (1842); 'Operative Chirurgie' (1844–48).

DIEFFENBACHIA, dēf-fĕn-bāk'ĭ-ą, a genus of *Araceæ* (arum family), of which there are about 15 species, found in the woods of South America and the West Indies. Their leaves have sheathing petioles, and are often variegated. Their form of inflorescence is the spathe-enclosed spadix characteristic of the order, the spathe in *Dieffenbachia* being green or yellowish. The best-known species is the poisonous dumb cane of the West Indies (*D. seguin*).

DIEGO GARCIA, dē-ā'gō gär-thē'ä, an island of the Indian Ocean, in lat. 7° S., and long. 72° E., extends in an irregular horseshoe shape, and is 30 miles long. It belongs to an archipelago known as the Chagos Islands. It contains a spacious bay, and is very convenient for coaling purposes. The group has about 700 inhabitants, and is a dependency of Mauritius.

DIELECTRIC, a name applied by Faraday to any medium through or across which electrostatic induction can take place. (See INDUCTION, ELECTROSTATIC). Solids, liquids and gases possess this property of transmission, though in differing degrees, and their dielectric value, or specific inductive capacity, is measured by the ratio of the capacity of a condenser in which each may form the insulator, to the capacity of the same condenser with a vacuum as insulator.

DIELMAN, Frederick, American painter: b. Hanover, Germany, 25 Dec. 1847. He removed to the United States in childhood, and was graduated at Calvert College. He was a topographer and draughtsman in the United States Engineer Department 1866–72; studied art under Wilhelm Diez at Munich, and established a studio in New York in 1876. He designed the mosaic panels, 'Law and History' in the Congressional Library at Washington, D. C., and was president of the National Academy of Design from 1899 to 1909. He was most successful as a genre painter. His best pictures are 'The Patrician Lady'; 'My Own Puss'; 'Lunching' and 'The Young Gamblers.' In 1903 Dielman became professor of drawing at the College of the City of New York and about the same time was made director of the art schools at Cooper Union, New York. He also assisted in promoting the Society of American Artists; was president of the Arts Federation of New York and an important figure in all art education and advancement.

DIELS, dēls, **Hermann,** German educator: b. Biebrich 1848. He was educated at the universities of Bonn and Berlin and in 1886 became professor ordinarius of classical philology at the latter institution. His most notable work is his 'Doxographi Græci' (1879), in which he first determined the sources of the doctrines of the Greek philosophers as trans-

mitted by post-Aristotelian scholars. He also issued an edition of Simplicius' 'Commentary on the Physics of Aristotle' (1882); and 'Ueber die Philosophenschulen der Griechen' (1887); 'Die Fragmente der Vorsokratiker, Griechisch und Deutsch' (1903; 2d ed., 1906–10); a treatise on the 'Sibyllinische Blätter' (1890). He was also a member of the editorial staff of the 'Commentaria in Aristotelem Græca' and of the *Archiv für Geschichte der Philosophie* (Berlin, 1887).

DIEMER, dyā'mär', **Louis,** French composer and pianist: b. Paris 1843. He studied at the Conservatoire under A. Thomas, Marmontel, Benoist and other masters, and took first prize for piano playing at the age of 13. In 1888 he was appointed professor of piano at the Conservatory in succession to Marmontel. At the Exposition of 1889 he gave a series of historical piano recitals, the great success of which induced him to devote himself to the older piano music. He is founder of the Société des anciens instruments and has published a fine collection of 'Clavicinistes Français.' His own compositions in the form of chamber music also include several pianoforte selections, concertstücks for violin, piano, and a brilliant pianoforte concerto.

DIEPENBEECK, dē'pĕn-bāĸ, **Abraham van,** Flemish painter: b. Bois-le-Duc, 9 May 1596; d. Antwerp 1675. He first studied glass painting, and a number of windows in different churches in Antwerp are his work. Later he studied under Rubens. He made a journey to Italy and on his return to Antwerp in 1641 became director of the Academy. Among his paintings are 'St. Norbert'; 'Ecstasy of St. Bonaventura'; 'St. Francis Adoring the Sacrament'; 'Entombment of Christ'; 'Neptune and Amphitrite'; and the 'Flight of Clœlia.' (There is some difference of opinion as to the authorship of these works, but they are generally ascribed to Diepenbeeck). He was engaged by Charles I and by the Duke of Newcastle to execute numerous drawings. He designed various tapestries and illustrations for books, among others 59 plates of a 'Temple of the Muses' (Paris 1655).

DIEPPE, dē'ĕp, France, seaport in the department of Seine-Inférieure, 93 miles north-northwest of Paris. It is situated between two ranges of chalk hills at the mouth of the river Arques. The harbor accommodation is extensive, there being an outer harbor and four inner basins or docks, and a dry dock 341 feet long and 23 feet deep, but Dieppe has been outdistanced as a port by Havre. The manufactures include works in ivory, the most famed in Europe; works in horn and bone, lacemaking, sugar-refining and shipbuilding. Fish is the staple trade. Imports include coal, iron, pitch and cement; exports, silk, wines, brandies, fruit and potatoes also manufactures. The church of Saint Jacques is the principal ecclesiastical foundation, built between the 12th and 16th centuries. Among educational institutions are a commercial college and a school of navigation. The suburb of Le Pollet, connected with the town by a drawbridge, is inhabited by sailors and fishermen said to be of Venetian extraction. The castle was erected for defense against the English in 1435, and successfully withstood siege in 1442, but was subsequently captured and destroyed several times. The town suffered severely from the plague in 1668 and 1670, and was reduced to ruins by the English and Dutch in 1694. It was occupied by the Germans during the Franco-Prussian War. Pop. 23,973.

DIERX, dē'ėr', **Léon,** French poet: b. on the Island of Réunion 1838. He was educated in Paris, where he became a member of the Parnassians. He has published 'Aspirations' (1858); 'Poèmes et poésies' (1864); 'Les lèvres closes' (1867); Les paroles du vaincu' (1871); 'La recontre' (1874); 'Les amants' (1879). The Academy crowned his collected poems (1889–90).

DIES AND DIE MAKING. In the manufacture of machinery by the modern duplicate system, in which every individual part is so nearly alike that it may be replaced for any other broken or worn part, the art of the die maker has become of great importance. The majority of working parts of machines — practically all but the heavy castings — are now made by machine forging, the rough metal stock being fed into presses, and cut and stamped into desired shapes. See MACHINE FORGING.

In order that the forging machine or press may do its work, it must be provided with dies for shaping the stock that is pressed or squeezed between them. Dies are commonly made in pairs, as shown in Fig. 1, the halves being termed male and female. They have to be formed with great accuracy, and require square, sharp, strong cutting or forming edges, and must be tempered as hard as is consistent with toughness. They may be designed in many ways. If it is desired to stamp washers out of thin metal, with a central hole of half inch diameter and one and a half inches over all, one pair of dies could be made to punch out the hole, wasting the half-inch center of metal, and another pair of dies to punch out the washer itself, wasting the spaces between the inch and a half circles. Or gang dies could be made, to punch out say 10 holes at a time, while another pair of gang dies at a following operation punched out the 10 washers complete. Or, better still, a progressive gang die could be made that would comprise both rows of half-inch punches and rows of inch and a half punches. This being placed in the press, and a long strip of metal fed in, and advanced at every stroke, so that the row of half-inch holes would be followed on the next stroke with the inch and a half gang, it is apparent that the press would turn out a series of complete washers at every stroke after the first. This outline will enable the reader to recognize that in die making the designer has to consider how many parts are likely to be made from the dies, and the greater the number the more labor and expense he is justified in putting in on the pair of dies to secure the largest output from the forging or stamping machine.

The first thing to be considered to determine whether a punch and die should be used to produce work is the number of pieces wanted. If it is standard work, and the demand is 100 or more per week, it is both desirable and economical to have a die made, for after the die is once made the work can be produced at a very low cost. Oftentimes when a large number of

pieces are wanted, and a power feed is used, the cost will not exceed two cents per 1,000 blanks.

The power required to blank out a piece of metal depends largely on the shape of the blank and the number of cutting inches in the die, a long narrow blank requiring more power than a round blank of the same area, the shear of the dies being equal. If the work will admit of the face of the punch being slightly rounding, less pressure will be required than with a flat-ended punch.

The making of dies calls for very expert workmanship both in design and execution, and the tempering requires an intimate knowledge of conditions and the consideration of the form and character of the die. A whole series of die-shaping, milling and filing machines have been developed for the special use of the die maker.

Following are the more common types of dies used:

BLANKING DIES.

These are made for cutting out flat blanks from steel, iron, paper, etc. Usually both punch and die are hardened and tempered; sometimes the punch is left soft, and as it gets worn is set out and refitted by being forced or shoved into the die; sometimes it is best to reverse this operation, as in punching paper, playing cards, etc., and harden the punch and leave the die soft.

Shear.—A shear or slightly beveled edge is usually given to the punch or die, determined by the work it has to do; when it is intended to use the blanks, or pieces punched out, the shear should be given to the die, as less distortion is given to the metal by this method, but where the hole is the object sought, as in rivet holes in boiler plates, etc., the shear should be given to the punch.

Die-shoes.— Cutting or blanking dies are usually held in a shoe or die-holder, or if a large die, it is fastened to the bed of the press direct, but as a rule the fewer pieces intervening between the press and the die the better results will be obtained. Very large blanking dies are usually made in one of two ways: either as rings set in a cast-iron holder, or by welding the rings directly on to a wrought-iron holder or die-plate; the latter method is the best in making plain dies, but cannot be used in compound dies. The welding of the steel rings together, and then on to the wrought-iron plate, calls for good work on the part of the smith. In the former method the rings are first welded and then turned, hardened and ground true in the universal grinder, then set in a groove turned in the holder and held there by being bolted from the back of the holder.

Hot Work.— In making dies for hot work (as the blanking out of nuts and other thick work from red-hot metal) a die made of chilled cast-iron with a good clearance will give good results, as the temper is not affected by the heat of the stock punched, the punch being made of steel and fitting the die loosely (in very thick stock a difference of 1/16" or more in the diameter of the punch and die is not too much), and if a nice job is wanted, the work can be shaved, or repunched, as it is called, by forcing it through a second die that is a trifle smaller than the first, leaving a true and smooth surface.

Repunching.— In the repunching of brass and copper, the use of buttermilk as a lubricant gives a better result than any oil or soap water.

BENDING DIES.

Bending dies are used for forming sheet metal or wire into almost any form that may be wanted. The die shown (Fig. 1) is for bending the piece on the right-hand side of the punch. This is blanked out by a previous operation, placed in the die by hand, and is bent as shown by the finished piece on the left-hand side. The two sides of the blank are bent down and the long one on the right is curved around the punch shown and the ring on the end is twisted around to a right angle to the rest of the arm.

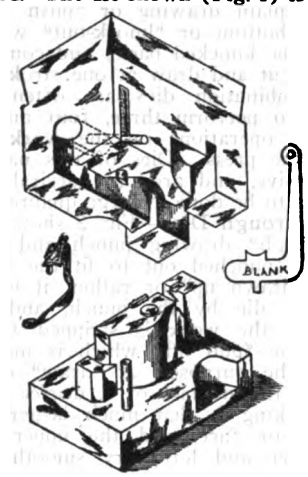

FIG. 1.

The Punch.— The punch is made from a single block of steel which is planed up to fit the press, and then machined out as shown in the cut. The twister, which is for turning the ring at right angles to the rest of the arm, is counter-bored and held in place by the quarter-inch pin driven into the side, and which is held up by the spiral spring seen at the upper right-hand corner of the sketch. The die is self-contained and is used in an ordinary single-stroke press, and requires no extra attachments to enable it to do the work. This same principle can be used in many cases, and the bending performed in one operation which would otherwise require two or more strokes of the press.

DRAWING DIES.

Drawing dies are used for shaping or drawing up sheet metal. The use of dies of this class is of comparatively recent origin; it having been first put into practical use by one De Vere of France in the latter part of the 18th century, and in the year 1827 the same process was patented for the drawing up of cartridge shells.

Origin.— In 1860 or 1861, two Frenchmen came to this country, bringing with them drawings of a model of a drawing press. These they had surreptitiously taken from a press upon which they had been employed in France. This press was secreted in a barn near the city of Wilmington, Del., and was finally perfected and put into actual use by Henry Marchand, who formed a company for the manufacture of the

same, known as the Higgins & Marchand Co. The first press was set up in one corner of the shop which was boarded up, and only three men allowed in the room. The first piece drawn up was a washbasin made from a 14" blank, which was probably the first piece of drawn work ever made in America.

Drawing dies may be divided into three kinds: the plain drawing or "push through" dies; solid bottom or "knock-out" where the work is to be knocked back; and combination dies which cut and draw at one stroke of the press. Combination dies are often so arranged as to perform three, four and sometimes more operations on the work at one stroke of the press. Dies of this nature are very expensive, and are only desirable when the work is to be done in large quantities.

Push Through Die.— Fig. 2 shows a plain "push through" drawing punch and die, the blank being punched out to fit the set edge, and then "drawn up" or rather, it is pushed through the die by the punch, and as the punch rises, the work is stripped from the punch by the "pull off" which is made very sharp for the purpose. A "draw" of about one-quarter to one-half of a degree is given the die, making it that much larger on the upper side or face, and the upper edge is rounded over and left very smooth and as

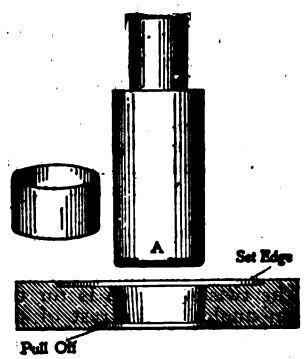

FIG. 2.

hard as fire and water will make it. "Don't draw a drawing die." The lower end of the punch is rounded and left in the same shape; often the die will work better if the finish is changed from a circular to a lateral polish. The diameter of the punch is equal to that of the die, minus double the thickness of the stock to be drawn. A die of this kind can only be used on shallow work, or in redrawing or reducing the diameter of the work that has been previously drawn up; if used on deep drawing it will pucker or crimp around the edge. To avoid this there must be a blank holder to hold the stock firmly while it is being drawn.

Single Action.— Fig. 3 shows a single-action cutting and drawing die, better known as a single-action combination die. A combination die is, as the name indicates, a combination of a drawing die and cutting die in one; it punches the blank, and at the same stroke of the press, draws it up into a cup or shell. The die shown is intended to be used in an ordinary single-stroke power press, and will draw up work not over one or two inches deep.

Double Action.— A double-action die is a modification of a single-action die, to be used in a double-stroke press; it can be used on work that is too deep for single-action dies. The one shown in Fig. 4 is known as a "push through" die. It is somewhat like the single-action die, except that the shell is cut by the punch (B) and is carried to the drawing die (D) and the

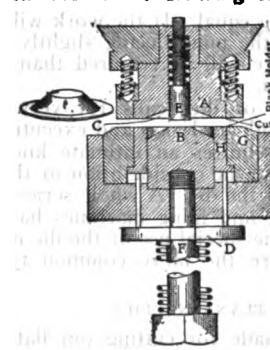

FIG. 3.

lower surface of the die acting as a blank-holder is held there while the drawing punch (A) forces it through the drawing die, and as the punch withdraws, the shell is removed by the lower edge of the die, which is ground very sharp for that purpose, and is known as the "pull off." The drawing die is held in place by the cutting die being clamped upon it by the ring (G).

This style of die has this advantage; the cutting and drawing dies are independent of each other, and can be changed for a longer or shorter shell, or either die can be repaired or replaced without changing the other.

Triple Action.— Triple-action dies are intended to punch, draw and stamp the work at the same stroke of the press. The construction is the same as the double-action, except that the die block is cut away to allow the stamping die to be set in place, and the shell is carried down to the stamping die and "struck up" between that and the matrix formed on the end of the drawing punch; as the punch rises, the work is stripped from the punch by the "pull off," and is removed from the dies by the use of an inclined press, or by a swinging arm attached to, and operated by the press, that catches the work as it falls from the punch.

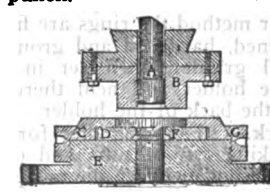

FIG. 4.

This style of die is largely used on blacking-box covers, lard-pail lids, or other work where a stamped or embossed cover is wanted. A die of this class should always be used in an arched press, as the strain of the stamping process is very severe on the "open back" style press, and is apt to crack the body of the press. In making a drawing

die, use a steel that is high in carbon, and if it shrinks a little in hardening so much the better. There is on the market at least one grade of steel which will stand three successive hardenings, and will shrink each time so that the die as it wears out can be "shrunk up" and then ground out to size again.

Various modifications of a drawing die are necessary in order to successfully draw up the different metals. Zinc works better when the soap suds, or whatever lubricant may be employed, is used hot as possible, as that metal works much better at a heat of 125 degrees.

Redrawing.— After a cup, basin, etc., has been drawn, to reduce its diameter still more and make it deeper, redrawing dies are used.

Thick Work.— In drawing very thick work the drawing die can be made bell-mouthed, as the thickness of the metal will reduce the tendency to crimp or pucker. The same method of making the die is followed when it is desired to draw a shell that is very short in proportion to its diamater.

The possibilities of what can be done by this method of forming up sheet metal are almost unlimited; trunks, wheelbarrows, sinks, and the copper boiler for hot-water service are every-day productions at the present time.

Metal.— The great secret of drawing up work is to have good metal, and to properly adjust the blank-holder, so as to hold the metal just hard enough to prevent it from puckering. In drawing up metal it should be borne in mind that it will flow where it can go the easiest.

EMBOSSING OR COINING DIES.

Embossing or coining dies, for coins or jewelry work, are used for striking up coins, medals, emblems, or other work that has to show the imprint and the figures which are cut in the die. Their manufacture is termed die-sinking. In the case of dies used for coin work, both the upper and lower die are embossed or engraved with the design or letter work that it is desired to have stamped on the coin; the blank being fed on to the lower die, which is surrounded by a knurled ring, and as the upper die or punch descends, the metal is confined and kept from spreading by the ring.

Dies used for coining are the oldest example of die work that we have any knowledge of as there are in existence a number of coins which were "struck up" over two thousand years ago; showing plainly that the art of die-sinking was known at that period, but the fact that they were left untrimmed or rough, on the edges, indicates that the process of punching by means of a close-fitting punch and die was not known at that time. Dies for coining could have been used in a press of very rude construction, the main requisite being that sufficient power was employed on the upper die or punch, to leave the desired impression upon the coin. This may have been done by the use of an ordinary maul or sledge, the upper die being held by hand. Coining dies are the highest example of the die-sinker's art.

Embossing Dies for Jewelry Work.— In jewelry dies the impression is usually cut or "hubbed" into the lower die, and the male die or "force" as it is called, being used to drive the metal into the lines drawn or cut, so as to bring up the desired design. Dies of this class are used to produce almost every known form of jewelry work. The back of a watch or locket, being a familiar example. Spoons, knives and forks, and in fact almost every article of tableware, are formed by the above method.

Hydraulic Dies.— Embossing is often done on very large pieces of work, especially on what is known as hollow-ware, such as ice-pitchers, etc., the blank being placed in the die, which is sectional and then put into the press. The blank is filled with water or sometimes a special composition of wax, which is then subjected to a very heavy pressure, forcing the pitcher or other work into the desired shape, and also into the lines which are sunk or cut in the dies.

FORGING DIES.

The use of dies for machine forging of metal is of recent date, and was first used in gun work, the hammer of a rifle being one of the first parts ever made in that manner. It consists of cutting a facsimile of the forging desired, either in the lower die, or sometimes it is divided equally into the upper and lower die, and then the metal, either iron, steel or copper, is heated and "drop-forged" into the impression sunk in the dies. See FORGING.

Flash.— The forging operation flings out a fin or "flash" as it is known, caused by the amount of metal being used in excess of what the dies will hold. This is either hot trimmed as soon as removed from the dies, or the work is allowed to cool and then cold trimmed; the latter work being done in an ordinary power press.

MULTIPLE DIES, ETC.

When a great many small and simple duplicate parts are required to be made, as nuts, hinges, lock-keepers, etc., it pays to make gang or multiple dies, in order that a series may be stamped out at low cost. Assuming that the stock will take on a row six wide, it is common to make a gang die with two rows of six punches, each row spaced far enough apart to admit of a row being punched out between them. In other words it is best for the gang die to punch out every other row at the first operation and then to punch the intervening spaces. If this is not done it is impracticable to stamp the rows very closely together, consequently this every-other-row arrangement saves stock.

Articles having a great number of holes, as colanders, sieves, strainers, etc., are made with perforating dies, that perforate usually without removing any metal as waste. The dies used to form the curled-over edge of various articles of tin and agate ware are called curling dies. They form a bead, often enclosing a wire to stiffen the edge. To give a handsome appearance to a part which may be conspicuous, burnishing dies are employed, which by applying pressure give an added smoothness and lustre to the piece.

Screw-cutting dies are made in pairs, to fit into a die-stock or screw-cutting machine. They have cutting edges that cut out a spiral of metal, and form the threads of screws, nuts, etc.

J. L. LUCAS,
Author of "Dies and Die Making."

DIES FASTI ET NEFASTI, dē'āz, a Roman division of days, with reference to judicial business, into working-days and holidays. *Dies fastus* was a day on which courts could be held

and judgments pronounced; *dies nefastus,* a day on which courts could not be held nor judgments pronounced.

DIES IRÆ (Day of Wrath), technically this supreme product of Latin hymn-writing is called a sequence because of its place in liturgical usage. It is first found in Italian missals in connection with the office for the burial of the dead and by action of the Council of Trent it became a formal element in the requiem service of the Roman Catholic Church. Its popularity may be judged from the fact that there are in existence nearly 150 versions of the hymn in English alone; the first one appeared at the close of the 17th century. One of the most popular versions, a condensed one, however, comes from the hand of Walter Scott in 'The Lay of the Last Minstrel.' It is generally recognized that it is a hopeless task to reproduce the simplicity and vigor of the original phrasing or to imitate the harmonies of the Latin diction. Mr. Saintsbury, the well-known expert in prosody, singles out as unique in this respect the line "Tuba mirum Spargens sonum," and in his eulogy of the poem as a piece of technique places its author by the side of Dante and Shakespeare. Yet the authorship of these verses is not firmly established. Most authorities are willing to accept the ascription to Thomas of Celano, the companion and biographer of Francis of Assisi. The attribution to Thomas is made in a vague way in a work written in 1385, considerably over 100 years after the period in which Thomas lived. There is nothing in Celano's biography of Francis to suggest the power in word painting displayed in the stanzas of this hymn. One of the first literary allusions to the Dies Iræ is of a depreciatory nature; a 16th century writer, Sixtus Senensis, speaks of it as an "inconditus rythmus," an uncouth poem. Assuming that the poem came from one closely associated with Francis of Assisi it would be easy to explain its eschatological austerity from the atmosphere known to have prevailed in Italy during the long struggle between the Papacy and the last Hohenstaufen emperor, Frederick II. Salimbene speaks of the hopelessness of a world order presided over by Frederick, who in his mind personified all the vices; and Albert de Beham, comparing the emperor to Lucifer, speaks of him as a man who tries to climb up to heaven, raise his throne above the stars and become superior to the vicar of the Most High. The theme of the Dies Iræ and the way it is handled do not reflect the naïve joyousness of Francis of Assis's temperament. Thomas of Celano's biography shows how open he was to the brighter side of the nature of his master. The hymn gives that other aspect of Franciscan teaching which appeared after the death of Francis with strong emphasis on apocalyptic terrors due to the impression made by the long career of Frederick, a versatile, constant and therefore dreaded opponent of the mediæval church system. Consult Chevalier, 'Poesie liturgique du moyen age'; Gebhard, E., 'Italie Mystique'; Julian, S., 'Dictionary of Hymnology'—Julian's Dictionary contains the text and critical remarks thereon. One of the best English versions is that by Dr. Irons, to be found in the 'Hymnal of the American Episcopal Church'; Kehrein, J., 'Lateinische Sequenzen des Mittelalters'; Warren, C. F. S., 'Authorship of the Dies Iræ'; Saintsbury, 'History of Literature'; Trench, R., 'Sacred Latin Poetry.'

WILSON LLOYD BEVAN.

DIES NON, more properly *Dies non Juridicus,* in law, a day on which justice or other business of court or law administration may not be legally undertaken. Under the old common law of England, and also in the United States all Sundays, Christmas Day, All Saints' Day and other holy days, belonged to the category of non-juridical days. In America certain legal holidays (not all) have been added to the list, while the holy days have been reduced to one. Christmas Day, and in some States, Thanksgiving and Independence Day are included. The present tendency is to reduce the number of non-juridical days, and even on such days exceptions are allowed and certain warrants may be issued and executed. These exceptions, in almost all jurisdictions, are now generally stated explicitly in the codes of procedure so that administrators of justice may know exactly which acts may, and which may not, be performed on such days. Consult *Southern Law Review,* N. S., 697.

DIESEL, dē'zĕl, **Rudolf,** German inventor: b. Paris 1858; d. 1913. He was educated in England and at the Polytechnic School, Munich. He became manager of a refrigerating plant in Paris, where he remained for some years, returning to Munich in 1895. For many years he conducted experiments in internal-combustion engines and about 1893 news of his discoveries in this field caused considerable comment. After several failures in trying to make direct use of the energy from fuel combustion, in 1897 he brought out the engine since known by his name as the Diesel engine. He subsequently brought it to a high state of perfection. He came to America in 1912 and there delivered a series of lectures and in the year following the British Admiralty summoned him to a consultation. He lost his life by drowning in the Channel while on his way to England. He published 'Theory and Construction of a Rational Heat Motor' (Eng. trans. by Donkin 1894) and 'Die Entstehung des Dieselmotors' (1913).

DIESEL ENGINE. See INTERNAL-COMBUSTION ENGINE.

DIESKAU, dēs'kow, **Ludwig August,** Baron, German general in French service: b. 1701; d. Surenne, near Paris, 8 Sept. 1767. He was adjutant of Marshal Saxe, whom he accompanied in the campaigns against the Netherlands, and became in 1748 brigadier-general of infantry, and commander of Brest. In 1755 he sailed as general to Canada, at the head of French troops, to assist in the campaign against the English. He ascended Lake Champlain with the design of attacking Fort Edward, ambushed a detachment sent for its relief and pursued them to the fort with the hope of entering it with them. He was, however, defeated by Sir William Johnson, was taken prisoner, suffering from four wounds, and remained in captivity until 1763.

DIESTERWEG, dē'stĕr-vāg, **Friedrich Adolf Wilhelm,** German educator: b. Siegen,

Prussia, 1790; d. 1866. In 1808–11 he studied at Herborn and Tübingen. He taught at Mannheim and at Worms for about two years, when he removed to the model school at Frankfort. Later he became rector of the Latin school of Elberfeld, and in 1820 was appointed director of the new Teachers' Seminary at Mörs. His years in this position enhanced his reputation as a teacher and writer on education and in 1833 he was made director of the Seminary for City School Teachers in Berlin. Because of his disagreement with the authorities regarding important phases of higher education he was in constant friction and resigned in 1847. He received a government pension in 1850 and thereafter spread his educational ideas solely through the medium of periodicals. In 1858 he was elected to the Prussian Diet. He was a follower of Pestalozzi and aimed at making every subject a means of education. His greatest services to education were through his work as a trainer of teachers, but he exerted also a wide and far-reaching influence through his writings. In 1851 he founded in Berlin the *Pädagogisches Jahrbuch* and published 'Wegweiser zur Bildung für deutsche Lehrer' (2 vols., 1834; 6th ed., 1 vol., 1890); 'Das pädagogische Deutschland' (1836); 'Streitfragen auf dem Gebiete der Pädagogik' (1837); 'Leitfaden für den Unterricht in der Formlehre' (1845); 'Lehrbuch der mathematischen Geographie' (1840; 18th ed., as 'Populäre Himmelskunde,' 1891); 'Unterricht in der Kleinkinderschule' (5th ed., 1852). Consult Rebhuhn, Adolf, 'Briefe Adolf Diesterwegs' (Leipzig 1907) and Richter, Karl, 'Adolf Diesterwegs Ansichten über pädagogische Zeit- und Streitfragen' (Leipzig 1913).

DIET, a meeting or assembly of delegates or dignitaries convened and held from day to day for legislative, ecclesiastical, political or administrative purposes; specifically, the legislative assemblies of the German Empire, Austria, Hungary, the old Kingdom of Poland, etc. (in German, *Landtage*). The Diet of the old German or Holy Roman Empire was composed of three colleges: one of electors, one of princes and one of imperial towns, and began with the edict of Charles IV in 1356. Originally a feudal body in which none but tenants in chief could appear, it was not until 1489 that the imperial cities secured the right to appear in all diets beside the higher estates of electors and princes. Each college deliberated by itself, the agreement of all three together with the assent of the emperor being finally necessary for passing judgment. The best-known meetings were those at Nuremberg 1467, Worms 1521 (at which Luther was excommunicated), Spires 1529 and Augsburg 1530. After the treaty of Westphalia in 1648, which closed the Thirty Years' War, its influence rapidly declined; but its meetings continued to be held at Ratisbon, until the dissolution of the Holy Roman Empire in 1806.

DIET. See DIETETICS; NUTRITION OF MAN.

DIETERICI, dē'tā-rē'tse, **Friedrich,** German Orientalist: b. Berlin 1821; d. 1903. He received his education at the universities of Halle and Berlin and traveled extensively in the Orient. In 1850 he was appointed professor of Semitic literature in the University of Berlin. His researches in the Arabic language and literature gained him a wide distinction. His numerous works include 'Alfiyyah Carmen Grammaticum Auctore Ibn Nâlik cum Commentario Ibn Akil' (1851); 'Mutafiflabü Carmina cum Commentario Wahidü' (1858); 'Die Naturanschauung und Naturphilosophie der Araber' (1860; 2d ed., 1876); 'Die Logik und Psychologie der Araber im Zehnten Jahrhundert' (1867); 'Die Lehre von der Weltseele bei deñ Arabern' (1872); 'Die Philosophie der Araber im ñeuñten und Zehnten Jahrhundert nach Christus' (1876); 'Die Abhandlungen der Ichwân Es-Safâ in Auswahl' (1883–86); 'Alsarabis philosophische Abhandlungen' (1890); 'Ueber das älteste Bekenntniss der Christenheit' (1895); 'Muhammad ibn Muhammad 'abu nasr al-Farabi: Die Staatsleitung . . . aus dem Nachlasse . . . F. Dieterici,' edited by Paul Brönnle' (1904).

DIETERICI, Karl Friedrich Wilhelm, German economist: b. 1790; d. 1859. In 1813–15 he was an engineer geographer in Blücher's army, was next engaged in the Ministry of Public Instruction, becoming later professor of political science in the University of Berlin. In 1844 he was made chief of the statistical bureau. He wrote very many works, dealing with political economy and statistics, including 'De Via et Ratione Œconomiane Politiciane Docendi' (1835); 'Statistiche Uebersicht der wichtigsten Gegenstände des Verkehrs und Verbrauchs im preussischen Staat und im deutschen Zollverband' (1838); 'Ueber Auswanderungen und Einwanderungen' (1847).

DIETETICS, a branch of hygiene, is the science or study and regulation of the diet. *Diet* is the customary allowance of food and drink taken by any person from day to day — either as a hygienic measure — or as a remedy in cases of disease. The words diet, dietetics and dietary, in their modern significance, appear to have a mixed origin. The dictionaries trace their derivation through the French *diète* to the Latin *diæta* and the Greek *diaita,* the latter signifying a manner of living. Another meaning, often marked archaic or obsolete by lexicographers, is "daily fare," "allowance of food," "daily pay."

> And for his diet, there was a continual diet given him of the king of Babylon, every day a portion until the day of his death, all the days of his life.— Jeremiah lii. 34.

This meaning has an evident connection with the Latin *dies,* day, and is followed in the modern use of the word dietary. As defined by Mrs. Ellen H. Richards, a dietary is "a known amount of food, of known composition, per person, per day." Popularly, dietary appears to be associated with cheap fare, perhaps because first used in connection with the allowance of food for paupers and prisoners. The word diet also conveys to the average mind the idea of a reduced food supply, probably because the individual choice is restricted.

Under primitive conditions, men satisfied hunger with any edible substances within reach. The progress of civilization, with the increase of material possessions, developed the epicure and gourmand, who magnified the pleasures of the table. The aid of the physician was then required to mitigate woes induced by over-indulgence. In the days of Hippocrates, dietetics

was the province of physicians, who thus aimed to undo the evils caused by wrong living. Later, economists like Count Rumford applied dietetic principles to feeding the poor of European cities. Some countries have employed experts to prescribe rations for keeping army and navy in fine physical condition at least expense to the government. The victory in the Franco-Prussian War of 1870 has been ascribed to the food experiments of German chemists. The *erbswurst*, or pea sausage, a food having merit for emergencies, was devised by scientists at that period. Oleomargarine was the result of experiments made for the navy under direction of the French government. The aim of dietitians of the present day includes all that has gone before, the best use of materials at hand, prescription of food for the sick and aid to the well in choosing such foods as shall maintain health, with due regard to pleasing the palate. The 20th century finds prevention wiser than cure, and endeavors by the prescription of food adapted to different ages and conditions of body to develop the sound body and sane mind. At the present time no less emphasis is laid upon diet for diseased conditions of the human body than in the past, but more attention is being

UNITED STATES DEPARTMENT OF AGRICULTURE.

Nutritive Ingredients (or nutrients) of food.

Food as purchased contains
- Edible portion. e. g., flesh of meat, yolk and white of eggs, wheat, flour, etc.
  - Water.
  - Nutrients
    - Protein.
    - Fats.
    - Carbohydrates.
    - Mineral matters.
- Refuse, e. g., bones, entrails, shells, bran, etc.

Uses of nutrients in the body.

Protein. e. g., white (albumen) of eggs, curd (casein) of milk, lean meat, gluten of wheat, etc.	Forms tissue.	All serve as fuel to yield energy in the forms of heat and muscular power.
Fats. e. g., fat of meat, butter, olive oil, oils of corn and wheat, etc.	Are stored as fat.	
Carbohydrates.	Are transformed into fat.	
Mineral matters (ash). e. g., phosphates of lime, potash, soda, etc.	Share in forming bone, assist in digestion, etc.	

largely fat, supplying the heat needed by bodies subjected to severe cold. A mixed diet, both animal and vegetable, has produced the most successful races.

The usual classification of food substances is outlined by the United States Department of Agriculture in the above table.

Sometimes it appears difficult to reconcile practical usage and scientific experiment as to food values, but this is due to an incomplete view of both sides. Many statements about foods are untrue because only one phase is presented. To decide upon the full value of any food we must consider both its physical and chemical composition, its economic value and its physiological effect in the body. The elimination of refuse, and the division and subdivision of particles in the process of manufacture are important factors in the nutritive value and digestibility of foods. Some experiments have shown that a larger percentage of peas and beans was digested when thoroughly cooked and sifted, after removing the hull, than when cooked whole. Such external digestion saves energy in the human organism. Whatever tends to cleanse and purify foods before cooking undoubtedly increases their real nutritive value. Medical authorities on dietetics have laid much stress upon the choice of foods, but hardly enough upon their preparation. A piece of meat or a vegetable, however innocent in itself, may be ruined in cooking, while one of doubtful value, by right processes of cookery, may become harmless and even useful. This is equally true from the economic standpoint. Count Rumford found that "the richness or quality of a soup depended more upon the proper choice of ingredients and a proper management of the fire in the combination of these ingredients, than upon the quantity of solid nutritious matter employed; much more upon the art and skill of the cook than upon the sums laid out in the market." The nutritive qualities of many foods are doubtless made more available by a wise use of flavors, which in themselves contain little or no nutriment. Condiments and spices, tea and coffee and the extractives of meats are of special value for the flavor which they impart. The cheap substantial grain foods after all provide the larger part of the food of the human race and are made palatable by changes in flavors.

The hours and arrangement for meals have an influence in the assimilation of food.

given to building up healthy bodies and then sustaining them by foods chosen with special reference to the work each individual has to do. Some study of dietetics is now included in the preparation of the citizen for life. In the public schools it is a part of the lessons in physical training, cooking or domestic science. A practical course in dietetics would cover the source and manufacture of foodstuffs, the processes of cookery and wise combinations of foods, the calculations of dietaries for individuals, families and institutions and the adaptation of foods to individual needs according to age, sex, climate and occupation. Students of history and sociology are recognizing the effect of food in forming individual and national characteristics. The French revolution and the destruction caused later by the Communists has been ascribed to the ill-fed condition of the people.

Fresh air, pure water and clean food are more essential for nutrition than any special selection of foods. The surroundings and instincts of a people lead them to adapt their diet to the climate. In the tropics fruits and vegetables are the main sources of subsistence, in arctic regions foods are chiefly animal and

Breakfast in America is a more substantial meal than it is in Europe, perhaps from climatic conditions. The midday dinner seems best adapted to children and invalids, the night dinner is a concession to the competition of business. One dietetic authority estimates that more than half of the day's ration of protein and fat and one-third of the carbohydrate is taken at dinner. Therefore the hour of the meal should be such as to provide for a period of rest afterward. The savage gorges himself when food is abundant, then sleeps like an animal. The gourmand of classic days took an emetic to relieve his stomach that he might partake of delicacies yet to come. The best thought of the present day tends to shorter menus and simpler compounds, toward "plain living and high thinking."

Dietetic theories vary from age to age because of imperfect knowledge of bodily processes, or because of changes in the production and preparation of foods. Water, for example, was once excluded mainly from the dietary of patients suffering from fevers, and its use restricted in other cases. Now it is recognized that a lack of water in the diet is a serious error and that many of our foods as served are not sufficiently diluted with water. In the past an exaggerated nutritive value was ascribed to beef tea and to gelatine, but later investigations show that the one should be classed as a stimulant and the other not so much a real food as a protein sparer. There is yet much discussion as to the relative value of whole wheat and white flour. The former is probably better for young children, because it supplies bone-making material, but by modern methods of milling most of the nutritive material in the grain is retained in the best grades of white flour. The natural instinct of children for sweets has been repressed, but now sugar is recognized as a valuable food, provided it is taken at proper times. Oysters are less nutritious than is popularly supposed, and as ordinarily cooked are not especially easy of digestion. Combinations of foods often produce different effects from the separate ingredients, and small quantities of certain things may be helpful where larger quantities would produce bad results. A food may be nutritious, economic in the true sense, and prepared in such a way as to be easily acted upon by the digestive organs and yet fail of perfect assimilation because it does not suit the habit or whim of the eater. In popular estimation a food is digestible when no feeling of discomfort follows after eating it, or when it is easily and quickly digested. The scientist considers a food digestible in proportion as it is completely digested, whether the time be shorter or longer. Persons in health should consume some foods that digest slowly and beware of depending upon pre-digested foods. If allowed to be idle, the stomach, like any other organ, soon finds it difficult to work.

The seven ages of man described by Shakespeare might illustrate the different periods of life calling for a change in diet.

The infant thrives and grows on a diet of milk. When the mother cannot supply a sufficient amount, clean milk from a healthy cow, by dilution with water or whey and by modification with milk and cream, may be adapted to the increasing needs of a baby as it develops. Greater cleanliness in collecting and transmitting milk to consumers is a first requisite for the diet of young children. Defective nutrition causes indigestion, rickets, intestinal catarrh and many disorders of childhood.

The schoolboy requires abundant food from which to construct his rapidly growing body and to provide energy for his active exercise. With him quantity is often more important than quality, while his sister, enjoying less active sports, is over-fastidious. Dainty children and excessively greedy ones both are usually ill fed. Nervous diseases of children, even stammering, will yield to more careful diet. Milk, fruit, cereals, whole wheat bread, eggs and vegetables should form the bulk of the diet of school children. The school luncheon now receives considerable attention from educators.

The lover and the soldier represent the college days and the strenuous life of early manhood. The training-tables for athletes in school and college are an admission of the need of a selected diet for special work. The definition of an army, given by a famous general — an animal that crawls on its stomach — indicates the importance of proper food for the soldier. No less necessary is it for captains of industry, pioneers and explorers of all kinds. Personal idiosyncrasy and differentiation of occupation demand attention to the individual dietary.

The judge is the type of the prosperous man of sedentary habit who is often overfed, and who should begin modifying his diet after passing the half-century mark, but habits are formed and changes must be made gradually. Luigi Cornaro, an Italian who lived in the 15th and 16th centuries, began at 40 to modify his diet and succeeded in passing the century limit. After he had reached 80 years he wrote several treatises describing his manner of living. That his writings are still the basis for much that is written on diet for the later years of life, is a sad commentary on the self-indulgent habits of the human race, which shorten many valuable lives.

> I have come to the conclusion that more than half the disease which embitters the middle and latter part of life is due to avoidable errors in diet, . . . and that more mischief in the form of actual disease, of impaired vigor and of shortened life, accrues to civilized man . . . from erroneous habits of eating than from the habitual use of alcoholic drink, considerable as I know that to be.
>
> SIR HENRY THOMPSON.

Last of all comes old age, and for this period the food should be similar to that of the young child, and taken often in small quantities. In proportion as activity diminishes, the intake of food should decrease. The sense of taste is dulled and higher seasonings may be desirable. Here if anywhere in a normal diet the stimulus of alcoholic beverages may be allowed.

During the last of the 19th century much data has been collected showing how people actually live, the cost of living and the proportions of protein, fat and carbohydrates. The studies on food and dietaries conducted by the United States Department of Agriculture have furnished much valuable data which is being used as the basis of further work on dietetics by authorities on both sides of the Atlantic. From such studies may be deduced approximate dietaries for different conditions. The ration enabling a man to do good work must necessarily be larger than one calculated merely to sustain life.

An estimated life ration for one day, measured in grams:

Protein.	Fat.	Carbohydrates.	Calories.
75.	40.	325.	2,000.

When poor families are found living on rations lower than this their diet must be enriched before they can be expected to display much energy. Prisoners often have different rations according to the time of sentence in some reformatories, and a man refusing to work is fed with stimulating food until he desires to expend some of his accumulated energy. A work ration would provide in grams:

Protein.	Fat.	Carbohydrates.	Calories.
125.	125	450.	3,500.

For severe labor this would be increased. (The calory is approximately the amount of heat which would raise one pound of water 4° F. and is a convenient standard of measure of the fuel value of food. The fuel value of protein is 4 calories per gram, or 1,820 calories per pound; fuel value of fats, 8.9 calories per gram, or 4,040 calories per pound; fuel value of carbohydrates, 4 calories per gram, or 1,820 calories per pound.)

The estimate of the value of food in construction of new tissues is less simple than its fuel value. It is impossible to measure the amount of good that might be done in schools, hospitals, and public institutions by improving the conditions of diet. Many hospitals now employ trained directors to make dietaries and superintend their preparation. The United States Department of Agriculture issues many valuable dietary bulletins.

Diet for the sick may be considered under three general heads: the typical ration for invalids, in fluid form, suitable for the crisis of acute disease; food for the convalescent or for building up a body wasted through lack of nutrition; and last, such diet as may aid in the reduction of an overloaded body but yet sustain the vital forces. For the first few days of an acute illness the human body may sustain itself on the surplus stored in its tissues. An invalid in bed is not using up energy so fast as the man at work, hence the diet should be less generous, not a work ration but a life ration increased in such directions as may best combat the waste of disease. Liquids are easily taken, quickly absorbed, and as a whole are less irritating than solids to the digestive organs. Concentrated foods are necessary in certain conditions, but these are few. A sick person for the time being is to be fed much like an infant — small quantities of food should be given often, usually warm rather than cold. Pre-digested foods should not be used until ordinary forms fail. Where there are wasted tissues to repair — as in convalescence or in diseases like anæmia, nervous prostration, or tuberculosis, the diet must be generous — milk and eggs are the main dependence, and the art of cookery has devised many simple ways of serving them. Fat, in easily digested forms — olive oil, bacon, cream and butter — is valuable in such cases, because fat is two and a fourth times as valuable for fuel food as the carbohydrates. For the capricious appetite attractive arrangement and service of the food, and the element of surprise are important. The cookery for the sick conforms to the usual formulas, though greater attention must be given to the selection of food and its preparation, and all doubtful articles must be avoided. Starches should be thoroughly cooked, woody fibre reduced by cooking and mashing, or removed by straining. Animal foods should be cooked at low temperature. High, composite seasonings are not desirable, but a moderate use of simple flavors is admissible. Gout, rheumatism, and obesity may not be due to over-eating in one sense, but indicate an excess of certain substances which are neither assimilated nor eliminated, but are stored up in the various tissues, causing discomfort. The many fasts of the early church perhaps were introduced less as a religious duty than as a wise dietetic measure. The "Banting" system for the reduction of fat consists mainly in decreasing the allowance of starch and fat and increasing the protein. Special diets for other diseases should, like medicine, be prescribed by the physician in charge, because of the complications to be considered. Water-cures, milk cures, and grape-cures have been successful in some cases. Increased knowledge of bacteria has explained many heretofore mysterious cases of poisoning, and has changed the point of view regarding the wholesomeness of various food products. Greater attention to cleanliness in all preparation of foods would make the use of preservatives practically unnecessary. With our rapid increase in prosperity Americans in future need to guard against over-indulgence of the sense of taste and to control the appetite to accord with the true needs of the body.

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DIETRICH, dēt'riH, **Auguste Edgard,** French writer: b. Nancy 1846. Early in life he took great interest in the study of the German language and literature, and was the first to translate two of Max Nordau's works into French. These were 'Les mensonges conventionnels de notre civilization' (1886) and 'Le mal du siècle (1890). He also translated Blennerhassett's 'Madame de Staël et son temps' (1890), and was a frequent contributor to *La Revue du Nord, La Jeune France,* and *Le Messager de Vienne.* He is the author of 'Les maitresses de Louis XV' (1881); 'Rouget de Lisle et la Marseillaise' (1882); 'Jacques Richard et la presse' (1886); 'La mort de Danton'

(1888). He edited 'Les poésies de Jacques Richard' (1885).

DIETRICH, Christian Wilhelm Ernst, German painter and etcher: b. Weimar, 30 Oct. 1712; d. Dresden, 24 April 1774. The picture of a peasant drinking, in the Dutch style executed by Dietrich while a boy, is in the Royal Cabinet of Engravings at Dresden. He successfully imitated Raphael and Mieris, Correggio and Ostade, but never produced anything of his own. His best work is his historical etchings. His paintings are scattered through almost all Europe, and especially in Germany. In the Dresden gallery, of which he was inspector, there are 53 of them.

DIETRICH VON BERN, a hero of German legend, celebrated for his amazing adventures, and figuring in the 'Nibelungenlied.' He was in actual life Theodoric the Great, founder of the Ostrogoth monarchy; but the two names have resulted in much confusion of legend with fact. He flourished in the 5th and 6th centuries of our era. Bern is German for Verona, the principal residence of Dietrich.

DIETRICHSON, Lorentz Henrik Segelcke, Norwegian poet and historian of art and literature: b. Bergen, 1 Jan. 1834. While an undergraduate in the University of Christiania, he composed many clever student songs which were collected and published in 1859. For a time he served as instructor at Upsala and subsequently for three years was secretary to the Norwegian minister at Rome. On his return he became connected with the administration of the Stockholm National Museum. He was appointed professor in the Academy of Arts, Stockholm, in 1869 and six years later removed to Christiania as professor of the history of art. He published several volumes mostly dealing with Norwegian art in the Middle Ages. He published the poem, 'Olaf Liljekrans' in 1857 and 'Kivleslatten' in 1859; 'Didactic Poetry in the North' (1860); 'The Art of Wood Sculpture in Norway' (1879).

DIETZ, dēts, **Feodor,** German painter: b. Neunstetten, Baden, 29 May 1813; d. Gray, France, 18 Nov. 1870. He studied in Karlsruhe under Karl and Rudolf Kuntz, and while there was greatly influenced by Feodor Ivanovitch. He also studied under Philip Foltz at the Munich Academy, and aided the latter in the decoration of the royal palace. In 1835 he executed his 'Death of Max Piccolomini,' now in the Karlsruhe Gallery, which brought him considerable fame. He spent three years in Paris, coming under the influence of Horace Vernet, and receiving the gold medal in the Salon of 1839. He was appointed court painter at Karlsruhe, but removed to Munich. He took part in the campaign of 1848 in Schleswig-Holstein, and in 1862 was appointed professor of the newly-founded School of Arts at Karlsruhe. He entered the army in 1870 in the Franco-Prussian War, and died in the service. He is best remembered as a historical and battle painter. His best works are 'Nocturnal Review' (1853); 'Destruction of Heidelberg by General Mela' (1856), in the Karlsruhe Gallery; 'Flight of an American Family Across the Susquehanna'; 'Blücher's March to Paris' (1868), in the Berlin National Gallery.

DIEU ET MON DROIT, dyė ė mŏn drwā (Fr. signifying «God and my right»), the motto of the arms of England, first assumed by Richard I, who flung this battle-cry at his French adversaries during the engagement at Gisors, 1198, to intimate that he did not hold his empire in vassalage of any mortal. It was revived by Edward III in 1340, when he claimed the crown of France. Except during the reigns of Elizabeth and Anne, who used the motto, *Semper eadem,* and of William III, who used *Je maintiendray* as his own motto (*Dieu et mon droit* being retained on the great seal), it has ever since been the royal motto of England.

DIEULAFOY, dy-ė-lā-fwā, **Jeanne Rachel Mayre,** French descriptive writer and novelist: b. Toulouse, 29 June 1851. She is the wife of A. M. Dieulafoy (q.v.). Her narrative of travel in 'Persia, Chaldæa and Susa' (1886), and her fiction 'Parysatis' (1890); and 'Rose d'Hatra' (1891), are evidences of her talent. She was made a member of the Legion of Honor. In collaboration with her husband she published 'Le théâtre dans l'intimité: Naïs la Sulamite, farce nouvelle du paté et de la tarte' (2 vols., 1900).

DIEULAFOY, Auguste Marcel, French engineer and archæologist: b. Toulouse, 3 Aug. 1844. In 1885 he discovered in Persia the remains of the royal residences of Artaxerxes. His discoveries are described in his 'L'art antique de la Perse' (1884–89). The Louvre contains a special department devoted to specimens of Persian architecture which he also collected and brought to France. Other works by him are 'L'Acropole de Suse d'après les fouilles executées en 1884–86' (Paris 1892) and 'Art in Spain and Portugal' (1914).

DIEZ, dēts, **Friedrich Christian,** German philologist: b. Giessen, 15 March 1794; d. Bonn, 29 May 1876. He fought in the War of Liberation, qualified himself as a lecturer at Bonn and was appointed professor of modern languages there in 1830. In addition to various works on the poetry of the troubadours, he published a very valuable 'Grammatik der romanischen Sprachen' (1836–42), which was translated into English, and an 'Etymologisches Wörterbuch der romanischen Sprachen' (1853), also translated into English. Diez laid the foundation of Romance philology, and to him all later investigators are profoundly indebted. His work stands in much the same relation to the Romance dialects as the researches of Grimm occupy with respect to the German dialects. Consult Breymann's 'Life,' published at Munich in 1878, and the centenary estimates by Behrens and Ritter, published respectively at Giessen and Geneva in 1894.

DIFFERENCE, in heraldry, an additional figure or an alteration in a coat-of-arms to distinguish one family from another of the same strain, or particularly to mark the difference between brothers and their descendants during the lifetime of the head of the house. Sometimes this is accomplished by variations of the bordure, such as having it ingrailed, invected, embattled, etc. But usually the eldest son bears a label or lambel; the second son a crescent; the third, a mullet; the fourth, a martlet; the fifth, an annulet; the sixth, a fleur-de-lys; the seventh, a rose; the eighth, a cross-moline; the ninth, a double quatre-foil. Such marks of heraldic distinction cannot be regulated by cast-iron rule or set law. Each country follows the customs

resulting from its own particular régime, which seem to be the adoption of changes on an escutcheon best suited to individual needs. Difference is commonly confounded with Cadency (q.v.).

DIFFERENCE OF LATITUDE AND LONGITUDE. See LATITUDE AND LONGITUDE.

DIFFERENTIAL CALCULUS. See CALCULUS, INFINITESIMAL.

DIFFERENTIAL EQUATIONS. See EQUATIONS.

DIFFERENTIAL GEAR. A gearing placed between the two inner ends of the divided driving shaft of a four-wheeled motor vehicle to permit the slowing down of the wheel on the inside of the curve when making a turn, although the engine is running at a constant speed. The inner ends of the divided driving axle are each fitted with a beveled gear wheel fixed at right angles to the axle. Between these two gear wheels are placed four bevel pinion wheels engaging the gear wheels on the axle at four points, 90 degrees apart. These pinion wheels turn loosely upon studs projecting inward from a ring-shaped beveled gear wheel which encircles them, and which is driven by a beveled gear pinion at the end of the driving shaft of the engine. The axle gears are driven by the opposite cogs of the pinion wheels, and when the friction of the road upon which a turn is made operates to hold back the driving wheel on the inside of the curve, the loose pinion wheels revolve on their studs, presenting another pair of cogs to transmit the motion of the ring gear wheel, thus adjusting the difference of speed of the driving wheels. Consult Pagé, V. W., 'The Modern Gasoline Automobile' (New York 1915).

DIFFERENTIAL SENSIBILITY. See DISCRIMINATION, SENSIBLE.

DIFFERENTIAL THERMOMETER, an instrument for determining the difference of temperatures between two points or places. That of Sir John Leslie is one of the best known, and will be found described under THERMOMETER. His invention is now used only as a thermoscope. Howard's differential thermometer is the most sensitive of this class of instruments. It consists of a U-shaped tube, the right-hand branch of the U being about twice as long as the other, and each arm terminating in a closed bulb. A scale is attached to the long arm. The liquid used is ether, and the apparatus is so constructed that air is wholly excluded, the gaseous element above the level of the ether being the vapor of ether. Rumford's differential thermometer is a very flat U-tube, with closed bulbs on both of its short arms. The entire tube is filled with air except a very short section of the horizontal part of the U, where there is a "block" of sulphuric acid. The scale is attached to this horizontal part, and differences in temperature between the two bulbs are marked by the travel of the sulphuric acid along the scale. A pair of thermo-electric junctions (see THERMO-ELECTRICITY) is generally preferable to any other kind of differential thermometer. One of the junctions is put at one of the points and the other junction at the other point and a galvanometer is introduced in the usual way into the circuit, great care being taken to keep all the other junctions of whatever kind that occur in the arrangement strictly at the same temperature. The strength of the current generated, which is measured by means of the galvanometer, is, with the limitation that will be found explained under the article just alluded to, proportional to the difference of temperature between the two thermo-junctions; and with the assistance of a previous experiment at known temperatures on the thermo-junctions employed, the absolute difference of temperature between the two points at which the junctions are placed may be determined with great exactness.

DIFFERENTIAL WEATHERING, the etching out either chemically or mechanically of softer or more soluble rock by wind or water, giving the weathered surface a pitted appearance. It is particularly characteristic of wind work in the desert.

DIFFERENTIALS IN RAILROAD TRAFFIC, a term of variable use in railroad and judicial commission practice, signifying fixed differences, established by agreement, between rates for similar or competing freight. They originated in a desire to equalize conditions, to distribute traffic fairly and to avoid rate wars, the short trunk "standard" lines allowing the longer roundabout "differential" lines lower rates on a fixed difference, and also on competing commodities, as dressed meats and live stock, wheat and flour. By decision of an arbitration committee in 1877, Atlantic seaboard differentials, because of stated disadvantages in ocean shipments, gave Philadelphia and Baltimore lower rates than those ruled for Boston and New York. See INTERSTATE COMMERCE COMMISSION; RAILROADS.

DIFFERENTIATION, *in biology,* that organic process which occurs when certain parts of a uniform whole become structurally different from the others, or when, in other words, the homogeneous becomes heterogeneous. Inequality in internal and external conditions of life brings about restriction of certain vital processes and the predominance of others, and as this division of function is established, diversity of structure results. Differentiation is the structural change which is associated with the physiological "division of labor," and the process is essentially the same whether it find expression in cells, tissues, organs or entire organisms. See DIVISION OF LABOR; EVOLUTION; VARIATION, etc.

DIFFRACTION OF LIGHT, the bending of the rays of light, due to interference, as of the slits or ruled lines in a diffraction grating. The study of the diffraction of light has given us the spectrum, and the study of spectra, through the spectroscope, has added greatly to the sum of human knowledge of the constituents of heavenly bodies. A simple way of noting the diffraction of light is to darken a room and allow a ray to penetrate between the edge of a shade and the window jamb. The light falling on the opposite wall is not a well-defined streak, like the aperture through which it passes, but is divided into a series of upright streaks or bands, showing that the rays of light bend or are diffracted in passing through the slit. Interesting experiments with diffraction can be made by allowing the light to pass through a hole or holes of different forms. The phenomena of diffraction were first noted and commented on by

Grimaldi of the Jesuits' College of Bologna in 1665. Sir Isaac Newton investigated the subject and explained it further. About 1819 Fresnel demonstrated that interference was the result of the wave motion of light and that sound waves are similarly affected. Joseph von Fraunhofer of Munich made a most exhaustive study of diffraction and classified the lines of the spectrum, which became known as "Fraunhofer's lines." He invented the diffraction grating about 1821 for exhibiting the lines and forming the spectrum. This grating as at first made was a glass surface, smoothed as perfectly as possible and covered with a thin film of gold-leaf, lampblack, gelatine or the like. Through this film were scratched or ruled parallel lines, constituting minute apertures for light. In order that these lines might be made very fine, close and accurate, the dividing engine was devised. With this were ruled a great many thousand lines to the inch. These lines must be exactly the same distance apart to be valuable. When the light was allowed to pass through the rulings or slits of this transmission grating to the screen the light on the screen was divided or dispersed, appearing in bands and forming a spectrum. It was found that to obtain a satisfactory spectrum a grating of 15,000 to 20,000 lines to the inch was desirable, and even very much finer rulings have been demanded and manufactured. In order to use gratings ruled on plane surfaces for spectroscopic purposes it is necessary to employ a telescope and collimator. After a time the reflecting grating was invented. In this a surface of spectrum metal was ruled, and this had some advantages over glass. Prof. Henry A. Rowland of Baltimore achieved distinction in the production of improved diffraction gratings, making a reflecting grating with a concave surface that can be used without lenses. The diffraction grating has been much used in studying the solar spectrum. See LIGHT; SPECTRUM; SPECTROSCOPE.

For further information as to diffraction gratings consult 'Gratings in Theory and Practice' (in 'Astronomy and Astro-Physics,' Vol. XII, 1893). For information as to diffraction consult Preston, 'Theory of Light' (London 1901).

DIFFUSION, in physics, is the gradual and spontaneous molecular intermingling of two gases or two liquids in contact into a homogeneous mixture. It takes place regardless of or in opposition to gravitation and is due to the mutual attraction of molecules. Diffusion is most commonly observed between gases, and the lighter the gas the faster does diffusion take place. It also occurs between viscous substances and, in some cases, between solids. A common experiment, exhibiting the diffusion of gases, is to place mouth to mouth vessels of hydrogen and oxygen. After a time it is found that the contents of both vessels are alike — a uniform mixture of the two gases. If the heavier gas is placed below the lighter the result is the same, demonstrating the fact that gravity does not check the result. If chlorine is one of the gases used its color will enable the eye to follow the diffusion. If a porous body is placed between the vessels the rate of diffusion can be measured. This fact is taken advantage of in the construction of the diffusiometer, invented by Thomas Graham. This instrument consists essentially of a tube containing a gas, the lower and open end of the tube being dipped in mercury, while the upper end is closed with a porous plug. The rise of the mercury in the tube serves to measure the diffusion of the gas through the plug. Another method of testing diffusion is to fill a diffusion-tube with — for instance hydrogen — and immerse the lower and open end in water, while the upper end is closed with the porous plug. Diffusion then takes place both ways, into the water and into the air.

Alcohol and water afford one of the readiest means of testing the diffusion of liquids. They will diffuse the same as gases, regardless of gravity. Stirring the two hastens the diffusion, because it brings a larger surface of one liquid against the other. At the same time the action is not a mixing in the ordinary sense, but a mixing of the molecules, forming a liquid that is of like composition throughout when the diffusion is complete. If water in a glass vessel be colored with a few drops of litmus solution and sulphuric acid be introduced through a tube to the bottom of the vessel, care being taken not to disturb the water, the diffusion may be observed visually. The water, which is blued by the litmus, turns from blue to red as the diffusion of the sulphuric acid progresses. The principle of diffusion is used in sugar making for extracting sugar from cane-juice and also from beets. Hot water is applied to the cut cane and sliced beets and diffusion withdraws a large part of the sugar, leaving in place the troublesome colloid matters which are present in the pressed juice of both beets and cane. Surgeons have also utilized diffusion to cause a liquid to pass through a membrane or tissue of the body. It is the principle of diffusion of liquids that enables the druggist to compound the several items of a prescription. The uniform strength of his solutions and extracts is also largely dependent upon diffusion. If it were not for this several fluids in a vessel would tend to arrange themselves in layers according to their gravity, as is the case with water and oil, which do not diffuse. Substances in solution also diffuse, following Fick's law of the diffusion of heat, that the diffusion of substances in solution is comparable to the travel of heat in conductors. As the temperature rises the rate of diffusion increases. Since the rate of diffusion of different solutions and liquids varies, it becomes possible to separate component substances in solution by taking advantage of the difference in rate of diffusion of each component. It has been demonstrated that some solids diffuse, though with extreme slowness. Lead placed upon gold for a period of years will be found to contain gold to a slight distance above the point of contact. When the metals are kept at a temperature of from 300° to 400° F., a recognizable diffusion takes place within 30 or 40 days.

For a fuller understanding of the diffusion of gases, see KINETIC THEORY. Compare also OSMOSIS, which is, practically, diffusion taking place through a membrane.

DIGAMMA, in the Greek language. In addition to the smooth and rough breathings the ancient Greek language had another, which remained longest among the Æolians. This is most commonly called, from the appearance of the character used to denote it, which resembled our letter F, a *digamma,* that is, double Γ. It

was a true consonant and appears to have had the force of *f* or *v* or our *w*. It was attached to several words which in the more familiar dialect had the smooth or rough breathing. Though the whole doctrine of the digamma is obscure, yet it is found in early Greek words, especially in Homer.

DIGBY, Sir Everard, English conspirator: b. 16 May 1578; d. 30 Jan. 1606. He enjoyed some consideration at the court of Elizabeth and James I, by whom he was knighted. Being gained over by Thomas Tresham to the extreme Catholic party, he was induced to give £1,500 toward the expenses for the execution of the gunpowder plot and was entrusted with the preparation of a rising in the Midlands. On the discovery of the conspiracy he was tried and hanged in 1606.

DIGBY, George, 2d Earl of Bristol, English legislator: b. Madrid 1612; d. 1677. He was educated at Magdalen College, Oxford. As a member of the Long Parliament he was noted for his opposition to the policy of Strafford. We next find him a member of the House of Lords, in which he supported the Royalists. In the Civil War which followed he served as lieutenant-general in the Royalist army. He emigrated to France after the rise of Cromwell, entered the French service as lieutenant-general, but was dismissed because he opposed Cardinal Mazarin. On the accession of Charles II he returned to England. His last public act was his lodging a charge of high treason against Lord Clarendon. He wrote 'Elvira; or, The Worst not Always True,' a comedy (1667).

DIGBY, Sir Kenelm, English author, diplomatist and naval commander: b. Gothurst, Buckinghamshire, 11 July 1603; d. London, 11 June 1665. His great-grandfather bore arms for Henry VII on Bosworth field; his father, Sir Everard (q.v.), died on the scaffold as one of the leading Catholic gentry implicated in the Gunpowder Plot, 1606. Kenelm was brought up a Roman Catholic. After completing his academic studies at Oxford he went on his travels through France, Spain and Italy; in 1628 equipped at his own cost a squadron against the Algerine corsairs, and incidentally defeated a Venetian force off Scanderoon (11 June). Returning home, he appears for a time to have oscillated between Protestantism and Catholicism; was imprisoned early in 1642 as a Royalist, and released in July 1643, but his property was confiscated, and he retired to France; there he was in high favor with the court and with men of learning and philosophers, among them Descartes. At the overthrow of the Royalist cause he returned to England and labored in the Catholic interest, but was banished under pain of death by the Parliament. He then for a time served the French king in various embassies, but under the Protectorate came back to England and was admitted to the intimate friendship of Cromwell. He was one of the founders of the London Royal Society. His works on physical philosophy, on natural science and on metaphysical subjects possess now only the interest of curiosity; among them are a 'Treatise on the Nature of Bodies,' 'Peripatetic Institutions,' 'Treatise on the Soul,' etc. On religious matters he wrote many books, among them 'A Conference About a Choice of Religion,' and 'Letters' on the same subject. His brief critique of Sir Thomas Browne's 'Religio Medici' gives a specimen of his style of argumentation. He was all his life an inquirer into occultism and wrote a book on 'The Cure of Wounds by the Power of Sympathy'; he hoped also to discover a means of conserving into old age the extraordinary personal beauty of his wife, and invented cosmetics to that end. Consult Longueville, T., 'Life of Sir Kenelm Digby' (New York 1896).

DIGBY, Kenelm Henry, English antiquarian: b. 1800; d. London, 22 March 1880. He was graduated from Trinity College, Cambridge, in 1819, and in 1822 published 'The Broad Stone of Honor,' "that noble manual for gentlemen," as Julius Hare called it, "that volume which, had I a son, I would place in his hands, charging him to love it next to his Bible." It was much altered in the 1828 and subsequent editions (the latest 1877), its author having meanwhile become a Roman Catholic. Among his other works may be named 'Mores Catholici, or Ages of Faith' (1831–40).

DIGBY, Nova Scotia, on Saint Mary's Bay, 150 miles west of Halifax. A United States consular agent is stationed here. The town is noted for its curing of a variety of small herrings or pilchards. Pop. 1,247.

DIGEST, in England and America, a legal work of reference containing rules, decisions and laws arranged under appropriate headings for facility of reference. Such a work may include also laws or statutes and case law in alphabetical order or may be confined to an index of judicial decisions containing the common law in substance. Of such works there exist a vast number, some of which are encyclopedic in scope and treatment. The best known are: of English law, the Digest of Fisher and Chitty; of American law, Abbott, 'Cyclopædic Digest of New York Decisions,' and 'Corpus Juris,' edited by W. Mack and W. B. Hale. In addition to these general works there are digests of decisions of the Federal courts and digests of the decisions of the State courts for each State. See Civil Law; Code. Consult Wambaugh, 'The Study of Cases' (2d ed., Boston 1894).

DIGESTER, a closed boiler in which a temperature above the boiling point can be obtained, the hot water and steam disintegrating or digesting the substance treated. The invention of the digester is credited to Denis Papin, a French scientist. He noted that anything boiled in an open vessel was not subjected to a heat above 212° F., as the water went off into steam at that temperature and was lost. Accordingly he constructed a boiler with a closed top to retain the steam and succeeded in securing a temperature of 400° F., which served to readily digest bones. This digester came into use for the manufacture of soups and gelatines from bones that had been previously wasted or thrown to the dogs. Within recent years the digester has found a place in a number of industries. The lard or grease tank of a slaughter-house is a digester. In some American cities digesters have been employed to receive garbage and se-

cure a product of some value from the refuse. Tannin is extracted from nutgalls by a digester, in which the material is saturated with ether.

The digester has found its most extensive use, however, in paper-making. The wood, which is abraded by grinders from the log, is introduced in a form resembling fine sawdust to the digester, and comes out pulped, ready to be rolled into paper. Sulphite digester is the common name for these mechanisms owing to the fact that a bisulphite solution is employed in the process of digesting. This serves as a solvent, but being acid would attack the iron or steel of which the digester is constructed. To protect the iron shell various linings are employed. The "Non Antem" digester employs a lining made of a continuous sheet of lead placed against the inner sides of the shell, and held in place by two courses of acid-proof brick. The Mitscherlich digester is lined with acid-proof brick laid in Portland cement. The Graham digester is made of sheets of boiler plate, with the lead lining soldered on before bending. The Partington digester is made spherical, so that the lead lining tends to maintain its place from its form; the lead is also burned to the iron. Pusey & Jones build a digester of welded steel, with double shells and no lining. The Schenck digester is also unlined, being made of deoxidized bronze, and in both of these last named the erosion is claimed to be very slight.

Most sulphite digesters are built in the form of an upright cylinder, with one or more manholes at the top, through which the ground wood is introduced. Steam is admitted by coils and a high temperature maintained for about eight hours. When properly cooked, the liquid is run off and the digested material withdrawn by manholes in the bottom. Digesters are used in the hydrolysis of starch to glucose by means of sulphuric or hydrochloric acid.

DIGESTION. The word digestion designates the physical and chemical changes which food substances must undergo before they can be absorbed into the blood and lymph. Only a few food substances can become part of the body without previous change. These are water, certain salts and grape sugar. The most important alimentary principles, namely, protein, carbohydrates and fats, cannot be absorbed in the form in which they are furnished by nature. The digestive process can be considered most conveniently under three headings: Secretion, Absorption and Peristalsis.

Secretion refers to the elaboration of complex juices which contain, as a rule, digestive enzymes. One of the secretions, the gastric juice, contains free hydrochloric acid. Others, like the saliva, the pancreatic and the intestinal juices, are alkaline. The processes by which these digestive juices are formed and brought to the surface of the organ in which the digestion takes place are complex and will require special description. When these secretions act on the food substances at the temperature of the body, the food substances are broken down into simpler compounds, the chemical molecule becoming smaller and smaller. Some physiologists claim that the molecule of the food substance is reduced to its component atoms before it can be taken up by the living cells that line the digestive apparatus. If food substances are forced to enter the animal organism without being digested, for example, if egg albumen is injected into the blood circulation, it is again excreted by the kidneys. Egg albumen is a foreign albumen and the object of the elaborate chemical process is to convert it into native albumen which chemically and physiologically corresponds to that which enters the normal or native structure of the body.

Under *Absorption* are included the processes whereby the dissolved food substances, namely, the soluble end products of proteid, carbohydrate and fat digestion are taken up from the mucous membrane of the stomach and intestines and carried directly into the blood, or indirectly by means of the lymphatics. The blood, in turn, carries these end products of digestion to the cells constituting the organs and tissues in the body. The most important seat of absorption is the intestines. To a certain small extent absorption can take place from the mouth and the stomach.

By *Peristalsis* we mean the periodic contractions and constrictions which the œsophagus, stomach and intestines undergo, and by means of which the contents of the digestive apparatus are moved from the oral end to the rectal end of the digestive tube. But these peristaltic movements are also essential to effect a proper mixing of the food with the digestive juices in the stomach and intestines. Peristalsis does not, therefore, always mean regular onward movement. At times, the food is churned backward and forward in a part of the intestines not longer than 8 to 10 inches causing it to be thoroughly mixed with the secretion, and in the ascending colon there is an actual anti-peristalsis which compels the food that has entered the large intestine through the ileocecal valve, after it has reached as far as the hepatic flexure of the colon, to return to the cecum. This may be repeated many times before the food is allowed to pass into the transverse colon.

To the eye the peristaltic movement consists of a constriction of the walls of the intestine which, beginning at a certain point, passes downward away from the stomach from segment to segment. The advancing area of constriction is preceded by an area of inhibition or relaxation. The peristaltic movement, therefore, consists of two acts — constriction of one small region, preceded by the inhibition of another small region immediately in advance of it. These seem to follow in definite sequence and, when combined in an orderly manner, will facilitate the onward movement of the intestinal contents. Bayliss and Starling were the ones first to describe this twofold character of the movement and they regarded it as a reflex which is controlled within the intestinal wall itself through intrinsic nerve ganglia and their afferent and efferent communications.

There are principally three kinds of peristaltic movements of the digestive tract, one, the regular peristalsis just described and shown to be of a twofold character by Bayliss and Starling; secondly, the rhythmical movement; and third, the anti-peristaltic movement. We will now describe the rhythmical movements. Whilst the food progresses onward during the regular peristaltic movement just described, it seems to remain in the same place during the rhythmical movement but is apparently repeatedly kneaded and what is at one time a string of food of the shape of a sausage,

continuous in one piece six or eight inches long, may be suddenly segmented into five or six small pieces. These may be recombined, only to be separated again. During these rhythmical contractions there is no steady progression of the food, although it is repeatedly subjected to divisions. From time to time, however, the separated pieces are caught by an advancing peristaltic wave of the first kind, moved forward about 6 to 10 inches and then gathered into a new mass which, in turn, undergoes segmentation. F. P. Mall has suggested that these rhythmical contractions may also act as a pumping mechanism upon the venous plexuses in the walls of the intestine and thus aid in driving the blood into the portal system. Similar movements have been described by Hertz in the human being.

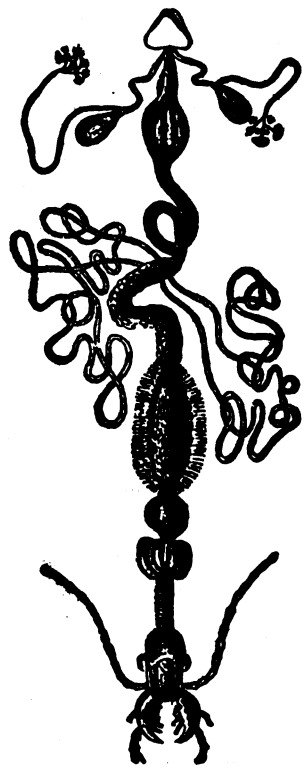

FIG. 1 — Digestive organs of Coleoptera.

Anti-peristalsis occurs under normal conditions nowhere except in the colon, particularly in the ascending colon. Under abnormal conditions, for instance, during complete intestinal obstruction, it may occur anywhere in the bowels.

The time required for the passage of the food from the mouth to the stomach is six seconds, if solid; one to two seconds, if liquid. The passage through the stomach may require from two to four hours, according to the quantity and quality of the food. The passage through the smaller intestine, according to Hertz, is about four hours and a half, though Hemmeter has described in the human being, studied by means of the X-ray, the passage of a meal from the pylorus to the ileo-cecal valve in two hours. The colon has the slowest peristaltic movement. The passage of the food through the colon may require from 10 to 14 hours.

Comparative Physiology of Digestion.— Digestion occurs in unicellular animals, such as the protozoa, in which Hemmeter has described the secretion of an acid into the food vacuole. When food that is stained with acid indicators, for instance, Congo red, is taken into the food vacuole of an ameba, it changes to blue, showing that an acid has acted upon the food.

The next highest class of animals, the Cœlenterates, possess a mouth and an alimentary tube which opens into the body cavity. A certain chemical digestion takes place in this tube and the digested food is absorbed through the cells of the endoderm, the lining membrane of this digestive tube. In the Medusæ fine canals radiate from the body cavity into the digestive tube and form part of the so-called gastro vascular system. In the Echinodermata we have a further development, a complete alimentary canal with mouth and anus, and entirely shut off from the body cavity. In many Arthropods it is possible already to distinguish parts corresponding to the stomach and the small and large intestines of higher forms, the digestive glands being represented by organs which in some groups seem to be homologous with the liver, and in others with the salivary glands of the higher vertebrates. A few Molluscs seem in addition to possess a pancreas.

Among Vertebrates, fishes have the simplest and birds and mammals the most complicated alimentary system. The stomach in the lower fishes is only indicated by a slight widening of the anterior part of the digestive tube. There are no salivary glands in water-living Vertebrates. The œsophagus is generally dilated to form a crop, in Birds, from which the food passes into a stomach consisting of two parts, one pre-eminently glandular (proventriculus), the other pre-eminently muscular (ventriculus). Among Mammals a twofold division of the stomach is distinctly indicated in rodents and cetacea, but this organ reaches its greatest complexity in ruminants, which possess no fewer than four gastric pouches. The differentiation of the intestine into small and large intestines and rectum is more distinct, both anatomically and functionally, in Mammals than in lower forms; but there are marked differences between the various mammalian groups, both in the relative size of the several parts of the digestive tract and the proportion between the total length of the alimentary canal and the length of the body. In general, the canal is longest in herbivora, shorter in carnivora. Thus the ratio between length of body and length of intestine is in the cat 1:4, dog 1:6, man 1:5 or 6, horse 1:12, cow 1:20, sheep 1:27. The relative capacity of the stomach, small intestine and large intestine is in the dog 6:2:1'5, in the horse 1:3'5:7, in the cow 7:2:1. The area of the mucous surface of the alimentary canal is very considerable, in the dog more than half that of the skin, the surface of the small intestine being three times that of the stomach and four times that of the large intestine. In the horse the mucous surface has twice the area of the skin.

The gullet or œsophagus is a long tube pass-

ing from the pharynx to the stomach. Its mucous coat is loaded with very large glands which secrete a quantity of very viscid mucus.

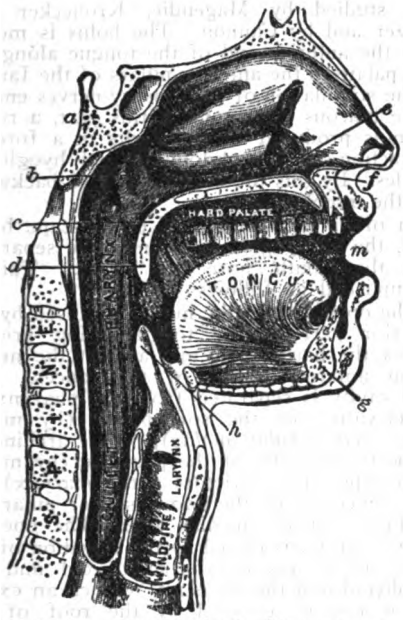

FIG. 2 — Section through Mouth, Nose, etc. — a, sphenoid bone; b, Eustachian tube; c, soft palate; d, uvula; e, nasal passage; f, upper jaw; g, lower jaw; h, epiglottis; m, mouth.

The stomach itself is a greatly dilated part of the digestive system. It may be said to consist of two parts, even in the human subject; a more complex arrangement is found in many animals, such as the ruminants. The large dilated portion into which the gullet opens is termed cardiac, and the opening the cardiac or œsophageal opening. The whole is lined with mucous membrane, which, in the empty stomach, is thrown into projecting folds or rugæ, but these folds are effaced when the organ is distended with food. In the membrane are innumerable glands which secrete the digestive juices of the stomach. The gastric juice is acid, due to the presence of hydrochloric acid. The ferments called pepsin and rennin, which is necessary for digestion, is secreted by special peptic or enzyme cells of the glands.

The food now called the chyme passes into the small intestine, a tube about 20 feet long. This tube, besides the muscular and mucous coats, possesses an external coat of loose fibrous tissue covered by a single layer of flat cells. This coat is prolonged into and helps to form the mesentery, a membrane connecting various loops of the bowel with each other and also the intestine with the abdominal walls. This membrane is called the peritoneum. The small intestine is somewhat arbitrarily divided into three portions — the upper (duodenum), the middle (jejunum), and the lower (ileum). The mucous coat contains glands very like the pyloric glands of the stomach, called Lieberkühn's follicles. They secrete the intestinal juice. In the duodenum one finds in addition highly branched glands called Brunner's. In both the mucous and sub-mucous coats, and generally involving both layers, are found masses of tissue — lymphoid — similar to that found in a lymphatic gland. Their function is probably connected with the blood and the blood corpuscles. Collections of these solitary glands, forming oblong patches about two inches long, are called Peyer's patches. In addition to the follicles of Lieberkühn and the glands of Brunner, there are the liver and the pancreas, which pour their digestive juices into the small intestine. The bile, which is the secretion of the liver, is formed continually by that organ, but the amount thus formed is influenced by the kind and quantity of food taken. The bile is to be looked upon not only as a digestive juice, but as a drain or excretion, whereby effete and useless matter is removed from the body. The pancreas is very similar in structure to a salivary gland. It secretes pancreatic juice which pours together with the bile into the digestive system, because the common gall duct and the pancreatic duct have a common orifice in the duodenum. The mucous membrane of the small intestine contains, in addition, little projections called villi. These are important organs of absorption. This property they share with the whole digestive system through any part of which, and especially through the walls of the small intestine, digested matter in solution passes into the numerous blood capillaries which form everywhere a dense network. The villi are peculiar, for each one contains in addition to blood vessels a small lymph vessel or lacteal. Nearly all the fat absorbed by the digestive system is taken up by the little cells of the villi, and passes on into the lacteals and thence into "*receptaculum chyli*" and thoracic ducts into the left subclavian vein.

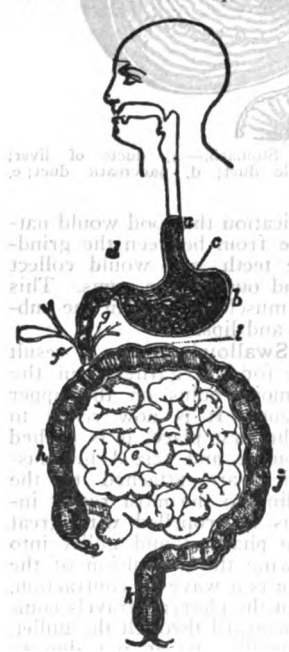

FIG. 3 — Alimentary Canal. — a, œsophagus; b, stomach; c, cardiac orifice; d, pylorus; e, small intestine; f, biliary duct; g, pancreatic duct; h, ascending colon; i, transverse colon; j, descending colon; k, rectum.

The unabsorbed food, mixed with the various secretions we have mentioned, now passes into the large intestine, where both digestion and absorption go on, though to a less extent. The large intestine is only five feet in length, but its lumen is much greater than that of the small intestine. It commences with cecum, a dilated part, into which opens a little blind canal (the vermiform appendix), in some animals a large and important structure. The large intestine ascends on the right side (ascending colon),

crosses over to the left side (transverse colon) and descends again on the left side (descending colon), and makes a bend (sigmoid flexure), and finally terminates in a somewhat enlarged portion (rectum). The mucous membrane of the large intestine differs from that of the small intestine in containing no villi or Brunner's glands. Lieberkühn's and solitary glands are present, but the aggregation of the latter into Peyer's patches is nowhere to be found.

When food is taken into the mouth it is at once swallowed, unless it is in a solid form. In this case it is chewed into a convenient size for swallowing, for which purpose it is, in addition, mixed with the viscid saliva and juices of the mouth. Many animals can hardly be said to masticate; such are the carnivora (dog, cat, etc.), and they are not provided with grinding teeth. In most animals living on vegetable food large flat grinding molars are found. In these animals, not only is the food finely divided in the mouth but the food, largely consisting of starch, is partially digested by the

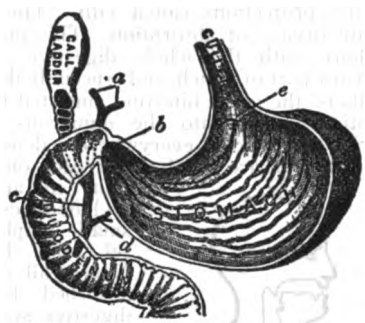

FIG. 4 — Section of the Stomach. — a, ducts of liver; b, pylorus; c, bile duct; d, pancreatic duct; e, cardiac orifice.

saliva. During mastication the food would naturally tend to escape from between the grinding surfaces of the teeth, and would collect within the mouth and outside the gums. This is prevented by the muscles placed in the substance of the cheeks and lips.

Physiology of Swallowing.—As a result of mastication, the food is gathered in the form of a round moist bolus on the upper surface of the tongue. It is now ready to be swallowed. In the first place, it is pushed backward by the tongue and seized by muscles, many of which are attached to the hyoid bone. According to the most recent investigation, the bolus is propelled with great rapidity through the pharynx and gullet into the stomach. Following the propulsion of the food downward there is a wave of contraction, which, commencing in the pharynx travels comparatively slowly downward through the gullet. It is evident that swallowing is not due to the falling of food down the throat. A horse drinks "up-hill," and the jugglers, or indeed anyone, can drink or swallow with the head vertically downward. When the food has reached the back of the mouth, swallowing occurs irrespectively of the action of the will.

There is a possibility that during swallowing the food may go the wrong way — that is, it may pass into the larynx and windpipe. It is prevented from passing into it by the elevation of the larynx which pushes its aperture against and under the back of the tongue, which at the same time is pushed backward.

The act of deglutition or swallowing has been studied by Magendie, Kronecker and Meltzer and by Cannon. The bolus is moved from the anterior end of the tongue along the hard palate to the anterior pillars of the fauces. By the stimulation of the sensory nerves ending in the mucous membrane at this part, a reflex action is produced which results in a forcible contraction of the mylohyoid and hyoglossal muscles. By this the bolus is pushed backward into the œsophagus.

In order that food shall only escape backward, the pharyngeal cavity must be separated from the mouth, nose and larynx. This is accomplished as follows:

The opening into the mouth is closed by the posterior part of the tongue being pressed against the hard palate and against the neighboring anterior pillars of the fauces. The nasal cavity is separated from the pharynx by the elevating of the soft palate (by means of the *levator palati mollis*), by the arching of the posterior walls of the pharynx (by means of the superior constrictors of the pharynx) and by the meeting of the two posterior pillars of the fauces at the median line. The opening into the larynx is closed by the elevation of the larynx by means of the mylohyoid and the geniohyoid and the digastric, to such an extent that it can be covered by the roof of the tongue and the epiglottis.

The first act of deglutition here described may occur with so much force that by means of it the food reaches the stomach. According to Kronecker and Meltzer this is accomplished by contraction of the mylohyoid muscle alone. This is especially true for liquids and soft foods. Only solid and dry foods remain in the pharynx or upper part of the œsophagus till the second step in deglutition carries them downward.

The second part of deglutition consists of a peristaltic movement, that is, a constriction of the œsophagus beginning at the top and traveling downward. The pharynx first constricts by means of the constrictors, then the œsophagus by means of the constriction of the circular muscles. Thus the parts of the pharynx and œsophagus successively constricted push the bolus toward the stomach.

The propagation of the contraction from one part of the œsophagus to another does not take place by direct conduction in the muscles, but is dependent upon the central nervous system. After the œsophagus has been cut across, the wave of contraction is set up in the lower part when it has ceased in the upper segment.

The nerve centres which govern the processes of chewing, sucking and swallowing lie in the medulla oblongata.

The walls of the stomach and intestines are, like the gullet, provided with muscular fibre. An external layer passes in the direction of the length of the gut, and within this is a circular layer. These muscles contract slowly on stimulation, and are outside the domain of voluntary action. During the digestion they contract peristaltically, moving the food toward the rectum. The peristaltic waves may begin in any part of the gut and pass slowly downward followed at varying intervals by other waves.

Vomiting Eructations.— Eructations are frequently caused by anti-peristalsis and by a movement of this kind, food is brought back into the mouth for further chewing in the ruminants (sheep, oxen, etc.). The act of vomiting is a reflex nervous act. It can be excited by stimulating the branches of the vagus nerve, as when indigestible and irritative food is taken, or emetics are administered. By tickling the back of the throat with a feather, the glossopharyngeal nerve is stimulated and vomiting may readily be produced. It is of frequent occurrence in irritations of the uterine nerves in pregnancy, of the nerves of the liver biliary apparatus and kidneys during the passage of a hepatic or renal stone, or indeed when irritation of any sensory nerves takes place. Vomiting may be caused by chemic substances acting directly on the vomiting centre in the medulla. Apomorphin acts in this manner. Irritating substances acting on the afferent nerves in the stomach can cause vomiting. Mustard acts in this manner.

In many animals, such as the sheep, ox and camel, the stomach consists of several cavities communicating with one another. In the ox and sheep the cardiac and the pyloric portions are each subdivided into two compartments. The cardiac part consists of a very dilated cavity, the paunch (rumen), into which the food is passed as soon as swallowed. In addition there is a smaller part, the reticulum (honeycomb), so called from the folds of lining mucous membrane which reduplicate, forming a reticulum. The pyloric half is divided into two parts. The psalterium (manyplies), so called from the lamellated appearance of its mucous membrane, communicates with the last division, the rennet stomach (abomasum). Fluid passes either into the first, second, or third part of the stomach, and thence on into the fourth. Solid matter, such as grass, roots, etc., passes either into the paunch or reticulum. This is mixed with the saliva swallowed with it and in addition it is mixed with juices formed by the mucous membrane of these cavities. When the animal has finished feeding, it lies down and rumination commences. Due in part to the contraction of the abdominal muscles and diaphragm, the food is propelled in the form of rounded pellets from the paunch and reticulum up into the mouth. The pellets are there thoroughly masticated, and are returned in a pulpy condition to the stomach. Now the food passes into the psalterium, and into the rennet stomach. Hence the consistency of the food determines into which part of the stomach it passes.

In the bird some interesting modifications in the structure of the alimentary canal are seen. The gullet at about the middle of its course is provided with a pouch or crop. Into this the food passes, and is bathed by a secretion formed by its glands. It is then propelled onward into a dilated cavity, the proventriculus, and is acted on by digestive juices. Thence it passes into the gizzard. This cavity is provided with muscular walls of enormous thickness in the case of birds that are vegetable feeders. It is lined by thick and corneous epithelium, and in its interior are generally found pieces of stone, chalk, etc. The gizzard is a powerful mill, which grinds the food into a soft pulp, upon which digestive juices can readily act. See BIRDS.

The most essential change which food undergoes in digestion is one of solution. This is effected by the chemic breaking down the large molecule of proteid carbohydrate and fat into smaller molecules. Some physiologic chemists claim that the complex food molecule is broken down to its very elements and completely.

The protein fat and carbohydrate of the food, if they were injected as such into the circulation, would not serve as food, but would be excreted as foreign matter — the proteid and carbohydrate by the kidneys, the fat by the intestines. Albumen, starch, fat, and other foodstuffs are insoluble in the circulating fluids. During digestion these pass either into nearly allied chemical substances which are readily dissolved in water, or in the case of fat partly into a soluble soap and partly into a state of microscopically minute subdivision. It is not sufficient, however, to have a soluble foodstuff in order that it may be absorbed and used by the body. Cane (table) sugar is soluble in water, but it is of no use as cane-sugar to the body. If injected into the blood vessels it is at once excreted by the kidneys. During digestion it is converted into glucose, but in a form which can be used by the economy.

The digestion of food is brought about by the action of the saliva, the gastric, pancreatic, intestinal and other juices. These are mixed with the finely divided food by the movements of the alimentary canal. The digestive juices are in all cases secreted by the microscopic cells which line the various glands opening into the digestive system. All digestive juices exert their efforts on the foodstuffs by means of chemic agents known as enzymes or ferments. These are not formed as *active* enzymes, but always as *inactive pro* enzymes, incapable of showing their specific digestive effect until they are made active by an *activator*. For instance pepsin is not secreted as such, but as pepsinogen. The pepsinogen is activated into pepsin by the hydrochloric acid (HCl) of the gastric juice.

When food is passed into the stomach, secretion occurs. In all cases the stomach, pale before, becomes suffused with blood, and the gastric juice is poured out. The flow of the intestinal juice, the pancreatic juice and bile all follow the stimulation of the mucous membrane of the duodenum, and in all cases the blood vessels enlarge so as to give the cells a good supply of blood, though, as we have seen, they themselves actually pass into a condition of activity as a result of the influence of special secreting nerves. Foods belong to four classes: (1) Proteids — albumens, globulins, etc.; for example, the white of egg, the chief constituent of meat, the gluten of bread. (2) Carbohydrates — starches, sugars, gums; for example, potato-starch, cane- or grape-sugar. (3) Fats and oils; for example, suet, marrow, olive oil. (4) Inorganic substances; for example, water, table salt, iron, phosphates.

A few substances are absorbed without being digested at all; for example, water and the salts, though even many of these undergo some physical change. Grape-sugar is absorbed and probably proteids too are often absorbed in very small amount. Fat is profoundly modified during digestion. The saliva, of which

about 30 ounces are secreted during the 24 hours, contains a ferment termed ptyalin, which is capable of turning boiled starch into a soluble sugar called grape-sugar, or, according to other observers, into another soluble sugar termed maltose. The ptyalin may be extracted from the saliva or from the salivary glands themselves. It does not appear to be much exhausted during its activity. The saliva is alkaline, and the starchy food is no doubt partly converted into sugar during its sojourn in the mouth by its action. Starch digestion may continue in the stomach for 45 minutes to 1 hour for the hydrochloric acid of the gastric juice does not destroy the ptyalin until the concentration of free HCl has reached 0.2 per cent. Any nondigested starch is subsequently converted into sugar when the food reaches the small intestine by the pancreatic juice.

The Nervous Control of the Gall Bladder and the Relation of the Secretion of Bile to the Peristalsis and Secretion of the Stomach. — As an example of the highly complex neurochemic reciprocal relations existing between the digestion in the stomach and digestion in the first part of the intestines below the stomach called the duodenum, we will describe the reciprocal innervation between the gall bladder and its outlet at the papilla of Vater. The orifice of the common gall duct on the papilla of Vater is at the same time the orifice of the pancreatic duct.

The vagus is the constrictor nerve to sphincter at papilla of Vater and inhibitory to the gall bladder. The splanchnic is the motor or constrictor nerve to the gall bladder and inhibitory to sphincter at papilla of Vater.

Stimulation of central end of splanchnic causes dilatation by reflex stimulation of vagus (inhibitory).

Stimulation of central end of vagus causes contraction of the bladder and a dilatation of sphincter at papilla of Vater.

Now, when there is no food in the stomach the sphincter of papilla of Vater is tightly closed, but as soon as food is taken into the stomach and digested, the solid chyme is spurted out through the pyloric sphincter, by the pyloric reflect (Hirsch — von Mering), into duodenum, and thereby stimulating the afferent fibres of the vagus. This stimulates the splanchnics reflexly, thereby causing inhibition of sphincter at papilla of Vater, and at the same time causing contraction of the gall bladder which shoots out the alkaline bile into the duodenum through the common bile duct. This then mixes with the gastric acid chyme, previously expelled through the pylorus, thereby making it alkaline, and this alkaline mass will cause the sphincter of the papilla of Vater to contract tightly through its stimulating effect upon the fibres of the splanchnics. Then follows a reflex stimulation of the vagus which results in a contraction of the sphincter of the papilla of Vater and relaxation of the gall bladder. Or in other words, the alkaline chyme stimulates this sphincter surrounding the orifice of the gall duct and pancreatic duct to contract reflexly, just as HCl, when present on the duodenal side, causes the pyloric sphincter to contract reflexly.

But the admirable nuerochemic adjustment is such that whilst acid HCl on the duodenal side of the pylorus causes the pyloric sphincter to close, this same acid reaction of duodenal chyme causes the sphincter of the papilla of Vater to relax, that the alkaline bile and pancreatic juice may neutralize this acid, for the enzymes of these juices require an alkaline medium for their best effect. When the duodenal chyme is again neutralized the pyloric sphincter opens, letting through four to ten cubic centimetres acid gastric chyme, but at the same time as long as the duodenal chyme is alkaline the sphincter of the papilla of Vater is closed.

The Chemistry of Digestion. Enzymes and Catalyzers. — The chemistry of digestion involves a knowledge of the enzymes. The substance upon which the enzymes act is called the substrate; thus the substrate for pepsin is proteid and the substrate for the diastatic ferment amylopsin is starch. The ferment attaches itself to the substrate and makes a new compound with it, which is capable of standing a higher temperature than the ferment alone. Proteolytic ferments, like trypsin of the pancreatic juice makes, distribute themselves on several different kinds of proteids, if such are present at the same time; but then the protein of the more difficult digestibility acts as an inhibiting substance to the ferment. An example of this is the manner of action of trypsin in a mixture of casein, fibrin and egg albumen. This inhibitive effect gave rise to the idea of anti-ferments in such solutions. The action of enzymes is very similar to that of the catalyzers of inorganic chemistry, but they do not act exactly as the catalyzers do.

According to Ostwald catalyzers simply accelerate a process that is already started and going on. However, it is well known that carbohydrates, proteins and peptones can be kept for years without any change if kept free of bacteria. Hence, ferments cannot be claimed to simply accelerate a process already begun.

The beginning of ferment action is extremely rapid. Sugar can be detected in starch almost immediately when saliva touches it. There is a glycolytic ferment in muscles which forms CO_2 explosively from glucose, provided pancreatic extract has been added. The rapid beginning is a constant sign if the enzymes are allowed to work under the correct conditions, but in experimental conditions this action ceases quickly; also, no matter how much glucose is present, the glycolytic action and CO_2 formation ceases in 2–10 hours. This is explained by the following possibilities: (1) Ferments may be used up. (2) They may be destroyed because they are labile. (3) They may be inhibited by products.

The characteristic manner of action of enzymes is quick onset and quick cessation. They may act by their presence, they may not be consumed and they do not appear as part of the end products.

For some enzymes it has been demonstrated that their action is reversible — that is, they may take place in opposite directions. One of the first demonstrations of this double effect was made by Kastle and Loevenhart in experimenting with an enzyme of the animal body known as Lipase. A necessary step in the digestion and absorption of fats is their splitting up into fatty acids and glycerine. These two chemists found that when they made use of a simple ester chemically analogous to the fats, namely, ethylbutyrate, that it was not only split up by Lipase into ethyl alcohol and butyric acid, but that the

two last-named substances could be resynthesized into ethyl butyric and water. In this case this reversibility can be chemically expressed by the following formula:

$$C_3H_7COOC_2H_5 + H_2O \rightleftarrows C_3H_7COOH + C_2H_5OH$$

Ethyl-Butyrate Butyric acid–Ethyl-alcohol

The Functions of the Gastric Juice — The Pawlow Experimental Stomach.— By means of a very ingenious surgical operation the Russian physiologist Pawlow prepared a secondary artificial stomach from the walls of the entire organ in the dog. The aim of the operation was to separate the stomach into a smaller and larger stomach in such a manner that the two portions did not communicate, but were separated by a partition made of the mucous membranes of the stomach. The larger portion of the stomach is so sewed up that it remains in continuity with the general digestive tract. The smaller stomach is made to open on the surface of the abdomen by a fistula. It was found by experiment that the juice secreted by the smaller stomach has the same composition as that produced by the large stomach. It had, moreover, the advantage of being free from admixture with food because no food could get into the lesser or artificial stomach.

The gastric juice thus obtained has a specific gravity of 1003—1005. It consists of 99 per cent water and nearly 1 per cent solids. The juice also contains free HCl acid in the proportion of 0.2 per cent. It is this HCl acid that explains the inversion of cane-sugar into equal molecules of glucose and fructose in the stomach, for it has been erroneously thought that the gastric juice contains a ferment to which the name Invertase is given, and to which this action was assigned. Similarly a variety of sugar which occurs in dahlia tubers and known as Inulin is converted by the HCl acid of the gastric juice into fructose.

Gastric juice has three functions in addition to that already mentioned. It converts proteids into proteoses by virtue of the HCl acid and pepsin it contains; secondly, it coagulates milk, and, thirdly, it acts on neutral fats but only such as are in the form of fine emulsion, such as yolk of eggs and milk.

The stages of peptic digestion of protein may be represented in tabular form thus—

Protein.
Soluble Globulin
Acid Metaprotein
Primary Proteoses
Secondary Proteoses
Peptones.

Some proteins which occur in food do not undergo these changes. Thus elastin is unaffected by peptic digestion in the time available in the stomach. The collagen of connective tissue is probably converted first into gelatine and then into gelatoses and gelatine peptones. The protein constituent of the conjugated proteins is usually converted into proteose and peptone, the prosthetic group being set free. Thus in the digestion of nucleo-protein by gastric juice an insoluble residue of nuclein is formed; in the digestion of mucin (gluco-protein), glucosamine is found in the products.

The effect of gastric juice upon caseinogen the phospho-protein of milk is peculiar in that there is a conversion of the caseinogen into a comparatively insoluble substance, casein. This action of gastric juice has been for many years ascribed to a separate ferment called rennin, but latterly evidence has been brought forward which suggests that the formation of casein from caseinogen is due to pepsin itself. The matter has not been conclusively settled, and it will be convenient to retain the term rennin in the meantime when describing the effect of gastric juice on caseinogen.

Adding rennin to milk and allowing it to stand at a temperature of 37° C. the milk soon becomes clotted, and after a time the clot shrinks, squeezing out a clear fluid, whey, which contains all the constituents of milk except caseinogen and fat.

Three factors are necessary for the formation of the clot, namely, caseinogen, rennin and lime salts. If rennin is added to a solution of caseinogen and the mixture is kept for a short time at a temperature of 37° C. and then boiled to kill the enzyme, the addition of calcium chloride will bring about the formation of casein. Obviously the enzyme has produced some change in the caseinogen, and the only factor required to complete the conversion into casein is the addition of lime salts. The process may be represented thus:—

Caseinogen + Rennin (or pepsin)
Soluble casein + Calcium salts
Casein.

Gastric juice also acts upon neutral fats, but only on those which are in the form of a fine emulsion, such as yolk of egg and milk. The fats are split into glycerol and fatty acids by the agency of an enzyme, lipase. The fat-splitting function of gastric juice, however, is limited in extent, and is of relatively small importance as compared with that which takes place in the small intestine. Pepsin indirectly assists the digestion of fat by dissolving the cell envelopes of the fats' cells of adipose tissue contained in the food. In this way fat is set free and prepared for the subsequent digestive action of pancreatic juice.

Nervous Control of the Secretion of Gastric Juice.— When a dog that has been provided with a Pawlow accessory stomach sees food or simply smells food gastric juice begins to drop from the canula in the accessory stomach. Also, if the œsophagus of the dog is divided and the two ends sewed to the surface at the lower part of the neck, food may be masticated and swallowed by the animal, but none of it will reach the stomach because it falls out of the end of the œsophageal fistula. In such an animal when food is eaten a secretion of gastric juice from the accessory stomach takes place; as no food has reached the stomach this indicates that the first secretion is due to a nervous reflex. The secretion of gastric juice will not occur if both Vagi nerves are cut.

The efferent nerves to gastric secretion are therefore the two Vagi. When juices produce purely nervous influence in the absence of any food reaching the stomach it is called a psychic secretion or appetite juice.

The Chemical Mechanism of Gastric Secretion.— Gastric juice may be secreted even after the two Vagi are divided. This type of gastric juice, therefore, would not be due to influence of nerves. The introduction of meat into the main stomach of a Pawlow dog

is followed in from 20 to 30 minutes by a secretion of gastric juice. The substances which stimulate gastric secretion act by directly exciting the cells of the gastric membrane, which, in turn, produce a hormone. The word hormone comes from the word ὁρμαω (I stimulate). There is a hormone formed in the pyloric end of the stomach, according to Edkins. It is called gastric secretin or Gastrin. Hormones are readily diffusible. They are of low molecular weight and each exercises a specific function in stimulating the activity of one particular organ or tissue, and when this function is performed it is rapidly destroyed in the body. It does not act as an antigen, that is does not excite the production of an antibody which would interfere with the performance of its function.

The hormones of the body are not destroyed by boiling like the ferments but are soon oxidized in the body, especially in the presence of alkalis.

The Composition and Functions of Pancreatic Juice.—Pancreatic juice may be obtained from animals by introducing a canula into the pancreatic duct and by an operation providing an external opening for this canula to empty itself into vessels tied underneath the abdomen of the animal. As early as 1677 Rene de Graaf employed a method of obtaining pancreatic juice and published an illustration of a dog with a pancreatic and also a salivary fistula. Consult Ernest H. Starling's work on 'Recent Advances in the Physiology of Digestion' (page 81).

Pawlow's method of making a permanent fistula is to cut out a patch of the duodenal wall with the opening of the pancreatic duct in its centre and stitch up the gap in the duodenum and then suture this patch containing the opening of the duct into the abdominal wall. Pancreatic juice obtained in this way is a clear, limpid fluid with a specific gravity of 1006, strongly alkaline in reaction. The degree of alkalinity is such that equal volumes of gastric juice and pancreatic juice neutralize each other.

Pancreatic juice contains four enzymes, a nucleo-protein, inorganic salts, chief of which is sodium carbonate. The enzymes are a protase called Trypsin, converting proteins into peptones and polypeptids; a diastase called Amylopsin which converts starch into maltose, but unlike saliva the amylase of pancreatic juice is capable of digesting unboiled starch; thirdly, it contains a lipase called Steapsin, and fourthly contains a milk curdling enzyme.

Pure pancreatic juice obtained directly from the duct without coming in contact with the intestinal membrane possesses no action on proteins. If, however, the juice has flowed over the duodenal membrane it becomes proteolytic. The inactive juice contains not Trypsin in its active state but it contains Trypsinogen, which is a precursor of Trypsin.

Trypsinogen is converted into active Trypsin by an activator or coenzyme which is formed in the mucous membrane of the small intestines and the name Enterokinase has been given to this activator. Trypsinogen may also be converted into Trypsin by calcium salts, but not so rapidly as by Enterokinase. Bayliss and Starling have shown that the secretion of pancreatic juice is due to a hormone which they called *Secretin,* and which is formed in the mucous membrane of the small intestine. The production of this hormone is brought about by the presence of the acids of the gastric contents when they enter the duodenum.

Pawlow has shown that stimulation of the vagus will start a small flow of the pancreatic juice even when the pylorus of the stomach is ligatured so that the passage of acid contents from the stomach into the duodenum is prevented. It is possible that the first few cc of juice of the pancreas that are secreted may be of nervous origin.

Secretin is not secreted in its complete or active form, but as a precursory state called prosecretin, and the amount of secretin in former as shown by the amount of pancreatic juice that is secreted varies with the nature of the food. The effect of Tryptic digestion may be represented in tabular form in the following manner:

Protein
Soluble Globulin
Alkali Metaprotein
Primary Proteoses
Secondary Proteoses
Peptones
Polypeptids and Amino-acids

The action of the pancreatic juice on starch is effected by an enzyme called Amylopsin or Amylase forming maltose from starch, but as the maltose is formed it is hydrolyzed by a ferment called Maltase contained in the pancreatic juice and also in the intestinal juice. Under the influence of maltase each molecule of maltose takes up a molecule of water and is split into two molecules of dextrose. Pancreatic juice differs, however, from the intestinal juice in having no similar action on other disaccharides, such as lactose and cane sugar.

Action of Pancreatic Juice on Fats.—If neutral olive oil be shaken with pancreatic juice and the mixture kept at a temperature of 37° C., the fatty ester will be hydrolyzed, producing fatty acid and glycerine, and the reaction will become acid. The digestion of fats is greatly aided by the presence of bile and also mechanically assisted by the formation of soaps. Some of the fatty acid which is set free combines with the alkali of the intestinal contents to form soap. Each fat droplet becomes coated with a fine film of soap, which prevents it from coalescing with adjacent fat droplets and in this way the formation of a still finer emulsion is brought about and the fat made more accessible to the fat-splitting enzyme.

Action of Pancreatic Juice on Milk.—When pancreatic juice is mixed with milk at the body temperature the milk soon clots, but as the clotting stage is very brief, the curd being dissolved by the proteolytic action of the Trypsin, the milk-curdling function has been ascribed by some authorities to the Trypsin and not to a special pancreatic rennin.

The Bile in Its Digestive Function.—Bile is to be looked upon not as a digestive juice in the same sense as saliva, but as an excretion which incidentally assists the digestive action of the pancreatic juice. The reciprocal relations, both chemical and nervous, existing between the secretion of gastric, pancreatic juice and bile have already been described.

As far as digestion is concerned, bile has five important functions. (1) It precipitates the acid-metaprotein and the proteoses resulting

from gastric digestion of proteins, and the conversion of a fluid or semi-fluid material into this solid condition allows more time for the action of pancreatic juice. (2) Bile salts act as a coenzyme or activator to each of the principal ferments of the pancreatic juice. In the presence of bile salts the power of the pancreatic amylase is doubled, the proteolytic power of Trypsin is doubled and the action of the pancreatic lipase is augmented 20 times. (3) Bile promotes the absorption of the products of digestion. When bile is prevented from entering the intestine 60 per cent of the fat of a meal passes into the fæces undigested, while normally the fat should almost have entirely disappeared from the fæces. (4) Bile salts stimulate the peristaltic movements on the intestines. (5) The reabsorbed bile salts stimulate the liver to further secretion.

Function of the Intestinal Juice.— Intestinal juice converts Trypsinogen into Trypsin by Enterokinase. It also contains two enzymes which convert the disaccarhides, cane-sugar and lactose into monosaccarhides. These ferments are called invertase and lactase. The terminal stages of hydrolysis of proteins are affected by a ferment called Erepsin. Erepsin acts on proteoses and peptones, splitting them up into amino-acids. The secretin spoken of in the preceding as causing the secretion of pancreatic juice is not poured out into the lumen of the intestines but reaches the pancreas by way of the blood channels. It is not a ferment because it is not destroyed by boiling. The normal stimulus for the secretion of intestinal juice is undoubtedly this very secretin and possibly other hormones. It is not satisfactorily demonstrated that the intestinal secretion is influenced by a nervous factor. Hemmeter has conceived of the digestive secretions as under control of two chemic factors — (1) stimulators, and (2) arresters of secretion. The first are the hormones already described. The second he designates as koliones from κωλων, to check or inhibit. Some of the end products of digestion act as koliones.

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Professor in Medical Department of the University of Maryland.

DIGHTON ROCK, a boulder of "greenstone" (in fact, bluish-gray), in Berkley, Bristol County, Mass., opposite Dighton, the landing-place for it; on the east shore of the Taunton River, about 10 feet from low-water mark, and covered two or three feet deep at each flood tide. It is 11½ feet long and about five feet high, with a flat face toward the river, once covered with inscribed characters varying from scratches to one-third of an inch deep, not chiseled, but "pecked" in. For many years the stream of visitors, unchecked by any authority, so often scrubbed off the tidal deposits of dirt with brooms and water to see the characters more plainly, that most of the latter are effaced and the whole past effective study. From old drawings, however, and comparison with similar petroglyphs elsewhere, there is no doubt it is Indian; Schoolcraft says, in the symbolic character of the Kekeewin. (Consult Garrick Mallery in annual report of the Bureau of Ethnology, 1888–89, pp. 85–86, 762–764; from Dr. Hoffman's examination of 1886). Enthusiasts at various times have made wonderful interpretations of it. Rafn of Copenhagen found the name of Thorfinn on the drawing sent him (consult his correspondence with the Rhode Island Historical Society 1830–34, in 'Antiquitates Americanæ, Copenhagen, 1837), and thought it a record of the Vinland settlement; an Orientalist deciphered "melek" (king), and considered it Phœnician, and another believed it Scythian. Many drawings have been made of it since the first by Samuel Danforth in 1680, and a second by Cotton Mather in 1712; for which, and a picture of the rock *in situ*, see Rafn as above, and for the drawings, the report above cited.

DI GIACOMO, dē jä'kō-mō, **Salvatore,** Italian dramatist and poet: b. Naples 1862. He made exhaustive studies of Naples, its environs, history and antiquities, and his literary work bears an mistakable evidence of his knowledge in this field. He wrote his plays and poems in the popular dialect of Naples. They attained great popularity throughout Italy and translations exist in French and German. The plays include 'O Voto'; 'A San Francisco'; 'O mese mariano'; 'Assunta Spina'; 'Quand l'amour meurt.' In 1910 a collected edition of his works appeared at Lanciano.

DIGIT, *in arithmetic,* usually signifies any one of the 10 numerals, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, though zero was originally not regarded as a digit. The word comes from *digitus,* a finger, thus indicating the humble means originally employed in computations. In mediæval times 10, 20 . . . 90 were called articles, and their combinations with digits were called composites. Digit is also a measure of a finger's breadth equal to three-fourths of an inch.

Digit, *in astronomy,* is the measure by which we estimate the quantity of an eclipse. The diameter of the sun or moon's disc is conceived to be divided into 12 equal parts, called digits; and according to the number of those parts or digits which are obscured, so many digits are said to be eclipsed. When the luminary is wholly covered, the digits eclipsed are precisely 12; and when it is more than covered, as is frequently the case in lunar eclipses, then more than 12 digits are said to be eclipsed.

DIGITALIN, dĭj-ĭ-tā'lĭn, the commercial name for a compound substance extracted from the seeds of the common foxglove (*Digitalis purpurea*), and containing digitoxin and the three glucosides, digitonin, digitalin and digitalein; and probably others. Some of these are deadly poisons, but of great medicinal value, while others are almost inactive or harmless. The earliest extract was Homolle's "digitaline," prepared from the leaves by the action of alcohol, acetic acid, lead oxide and ether. It is a white, bitter, partially crystalline body without smell, soluble in alcohol, but not in water or ether, and has been used in medicine, under the name of digitalin or digitalis. It contains digitoxin and a glucoside, digitophyllin; the latter being, apparently, identical with the "crystalline digitalin" of Nativelle. But no digitalin proper, or digitonin is found in the leaves of the foxglove. Another digitalin was obtained by Walz by treating that of Homolle with ether and water; it is a sort of "camphor," yellow, amorphous, soluble in water, and very powerful in its action, and has received the name "digitalein." Another chemist, Nativelle, obtained from the leaves two crystalline bodies,

known as digitalin and digitin, and an amorphous one called digitalein. It is to this last-named substance that the powerful physiological action of the drug is to be ascribed. Digitalin, prepared by various processes, and probably not chemically pure, is employed in medicine, being useful in stimulating the action of a weak heart, and effective also in removing dropsical fluid by its action on the kidneys; but it is apt to derange the stomach and bowels, cause loss of appetite, etc.

DIGITALIS, dĭj-ĭ-tā'lĭs, a name given to the leaves of the plant *Digitalis purpurea* (see FOXGLOVE), of the second year's growth. This is a biennial herb which is largely cultivated for ornament. It is about two to five feet high, with large succulent leaves and tubular urn-shaped purple flowers growing in a raceme. It is a native of southern and central Europe, and is extensively cultivated throughout the world, although the cultivated leaves are not as serviceable as those of the wild plant. The leaves, which lose on drying about 75 per cent in weight, are mostly obtained from the wild plants growing in the mountainous regions when two-thirds of the flowers are expanded. The leaves should not be kept more than one year, as the quality deteriorates very rapidly. The active principles in the digitalis leaves consist of four or five glycocides: digitoxin, digitophyllin, digitalin, digitalein and digitonin. The seeds also contain large amounts of active glycocides. The action of digitalis on the body is complex. It is primarily a local irritant causing secondary paralysis of the sensory nerve-endings. It is bitter to the taste, followed by burning and swelling of the mucous membrane. It is an irritant to the intestines, where it may cause nausea and vomiting. After absorption the chief action of the drug is on the central nervous system, the heart and the blood vessels. The action on the nervous system is of secondary value to the heart activities, although there is distinct stimulation throughout. The action of the drug on the heart-muscle is the most important property possessed by digitalis, both pharmacologically and therapeutically. Here, by reason of the complicated physiology of the heart action, the differing effects of digitalis on this organ are somewhat difficult to comprehend. Digitalis stimulates primarily the muscular fibres of the heart. It stimulates the cardiac nervous ganglia; and it stimulates, and then paralyzes, the cardiac inhibitory nerve, the pneumogastric. Thus the normal heart, under the action of small doses of digitalis, is at first made to beat somewhat more strongly and rapidly; but as soon as its action upon the pneumogastric becomes manifest, in larger and increasing doses, the heart action becomes more powerful and is somewhat slowed; and in full medicinal doses, frequently used in medicine when the effects of digitalis are desired, the action of the heart is much stronger and considerably slower. The blood-pressure is high, and the arteries are contracted. If, however, the use of digitalis is pushed beyond this point, its action as a paralyzant of the pneumogastric begins to be evident. By reason of this loss of the inhibitory action of the pneumogastric, the heart action at first is stronger, and the beat becomes more rapid. If still further toxic doses are given, the heart runs away, as it were. It beats very rapidly, irregularly, and with increasingly weakened force, until it finally stops exhausted. Digitalis also increases the secretion of urine; it raises the pressure of the blood vessels, and increases the amount of blood in all the organs of the body, including the heart itself. It is thus one of the great cardiac tonics, when used within physiological limits, and is indicated in most cases of heart disease where there is malnutrition caused by the dilatation of the chamber or a leakage of the valves.

DIGNE, dē'ny', France, capital of the department of Basses-Alpes, 60 miles northwest of Marseilles, at the confluence of the Bléonne and the Durance. It is encircled by walls, and has narrow, crooked streets. It contains a public library, a modern lycée and a cathedral. It is an important fruit-growing centre and has a trade in dried fruits, confits, marble, honey, wax, woolens, linen, skins and leather, etc. There are hot saline springs nearby. Dinia was its name in Roman days and it is mentioned by Pliny. In 1629 its population was nearly wiped out by the plague. Consult Guichard, 'Souvenirs historiques sur la Ville de Digne et ses Environs' (Digne 1847). Pop. 7,317.

DIJKSTRA, dīk'stra, **Waling,** Frisian poet: b. Vrouwen Parish, Friesland, 1821. His numerous poetical works contributed greatly to the spread and cultivation of the Frisian language and literature. His best-known works are 'Doaitse mei de noardsce balke' (3d ed., 1875); 'De silveren rinkelbel' (3d ed., 1887); 'In doaze fol alde snypsnaren,' in collaboration with Van der Meulen (2d ed., 1882); 'Friske winterjounenocht' (5 vols., 1861–76); and 'Uit Frieslands volksleven van vroeger en later' (Leeuwarden 1892), by many deemed his greatest work.

DIJON, dē-zhôń' (ancient *Dibio*), France, chief town in the department of Côtes d'Or, and formerly capital of the old duchy of Burgundy. It is a well and regularly built town, situated at the confluence of the rivers Ouche and Suzon, 211 miles southeast of Paris by rail. It is encircled by eight forts, those formerly nearest the city having made way for handsome boulevards. The church of Saint Bénigne (who was martyred here in the 2d century) is the most important ecclesiastical structure; its choir is of the 13th and nave of the 14th centuries. Down to the Revolution there existed a curious circular church in imitation of that of the Holy Sepulchre, with a spire 300 feet high. The church of Notre Dame is of pure Burgundian Gothic and possesses a clock of date 1382. The church of Saint Jean is a 12th century structure now degraded into a hay-store. The palace of the dukes of Burgundy, begun 1366, now does duty as town-hall, but its front has been entirely modernized. The carvings and tracery within are exquisite. The museum is specially valuable for its collection of relics and monuments of mediæval times. The theatre has a fine Corinthian portico. The ancient burial place of the dukes of Burgundy, founded in 1383, now serves as a lunatic asylum. Dijon is the seat of a university with three faculties and a valuable library. It is the centre of the wine trade of Burgundy, is famous for its mustard and has manufactures of machinery, automobiles, boots and shoes, flour, beer, biscuits and soap. Dijon was the birthplace of Bossuet. It was in German occupation in 1870. Pop. 76,847.

DIKA, dē'kȧ, a vegetable fat obtained from the seed of a West African tree, *Irvingia barteri,* of the family *Simarubaceæ,* used in making fine soaps. It resembles cacao-butter and makes very hard soaps. The tree has alternate, entire leaves and drupaceous fruits.

DIKAMALI, dĭk-ȧ-măl'ĭ, a resin exuding from Indian trees of the genus *Gardenia,* especially *G. lucida* and *G. gummifera,* a solution of which is used to dress wounds and open sores. These trees belong to the family *Rubiaceæ.*

DIKE. See DYKE.

DIKE, *in geology,* a term used to describe a mass of igneous rock, filling a fracture in some other rock. It may be vertical, inclined or even horizontal. The filling rock was injected in a fluid condition. Dikes vary from sills in that the latter are intruded along bedding planes parallel to the stratification of sedimentary rocks. A sill may vary from horizontal to vertical, depending on the position of the beds between which it is intruded. A very small dike, a fraction of an inch through and a few inches long, projecting from some larger igneous body, is known as an apophysis. Dikes and sills may consist of either basic or acidic rocks, and are usually much greater in two dimensions than in the third, being from a few inches to several feet in thickness, and often hundreds of feet, or even many miles in length and breadth. It is not uncommon for valuable minerals to be associated with dikes.

DIKE, dē'kē, in Grecian mythology, the avenger of wrong and the rewarder of virtue. She is the daughter of Zeus and Themis and is considered one of the Horæ.

DIKOA, dē-kō'ȧ, Africa, town of the old kingdom of Bornu, in central Africa, included in the former German colony of Kamerun, about 25 miles south of Lake Chad. It is fortified and was at one time the residence of the ruler of the native kingdom. Pop. 15,000 to 25,000.

DILATATION. See HEART-DISEASE.

DILEMMA (from Gr. *dis,* twice, and *lēmma,* an assumption), in logic, an argument in which the same conclusion may be drawn from two contrary propositions. A person is said to be in a dilemma, or on "the horns of a dilemma," when each of several courses of action would lead to an unsatisfactory result. We append one of the most famous of the classical dilemmas. A young rhetorician said to an old Sophist: "Instruct me in pleading and I shall pay you when I gain a cause." The master sued for the reward, and the scholar eluded the claim by a dilemma. "If I gain my cause I shall not pay you, because the award of the judge shall be against you. If I lose it I may withhold it, as I shall not have gained a cause." The master replied: "If you gain you must pay me, because you promised to pay me when you gained a cause; if you lose you must pay me, because the judge will award it." When the case came before the judges they were unable to decide it.

DILETTANTE, dĭ-lĕt-tăn'tē, an Italian expression; in its original sense signifying a lover of the arts and sciences, who devotes his leisure to them as a means of amusement and gratification. The term was originally applied to a lover of Italian vocal music, and was at one time the name of a party which upheld the superiority of that class of music. In contemporary usage the word has come to mean more or less of an artistic trifler. In 1734 a number of gentlemen founded a Dilettanti Society in London, with the object of combining social intercourse with the cultivation of artistic knowledge. On the rapid accumulation of the funds, the members resolved, in 1764, to send out an expedition to collect details and drawings of the most remarkable artistic monuments of antiquity. Messrs. Chandler, Revett, Stewart and Pars accordingly were sent to Asia Minor and returned with the materials for the splendid work on Ionian Antiquities, published at the expense of the society, the first volume of which was issued in 1769; a second volume was published in 1797, and a third in 1840. Among other works published by the society are 'Specimens of Ancient Sculpture, Egyptian, Etruscan, Greek, and Roman' (2 vols., imp. folio; London 1809, 1835); the 'Unedited Antiquities of Attica' (imp. folio; London 1817); the 'Temples of Ægina and Bassæ' by C. R. Cockerell (folio; London 1860).

DILIGENCE, the name originally given in French-speaking countries to a public conveyance of the nature of a stage-coach. The name was also adopted by other countries for their public carriages. The French diligence was a national vehicle going over regular routes periodically. It was a huge, heavy, cumbersome affair, upon four broad wheels which never covered a greater distance than six miles an hour. It had three compartments designed for the same number of classed passengers. Two officials accompanied the diligence on its trip; a *postillon,* who managed the horses, and a *conducteur,* who looked after the passengers and their traps.

In law, the care and attention which a person is required to show in a given situation in his relations with others. There are three degrees recognized by jurists: ordinary, less than ordinary and more than ordinary. It is a term of frequent occurrence in the law of negligence and bailments.

DILKE, Charles Wentworth, English journalist, antiquary and critic: b. 8 Dec. 1789; d. Hampshire, 10 Aug. 1864. He entered the civil service as a youth, became a clerk in the navy pay office and retired on a pension in 1836. All his leisure meanwhile was devoted to literature, and already in 1814–16 he produced a continuation of Dodsley's 'Old Plays.' He was an intimate friend of Keats and knew Shelley, Leigh Hunt and Tom Hood. Keats went to stay for a time with Dilke's father at Chichester in January 1819, carrying a letter of introduction from Mrs. Dilke. Up to 1829 Dilke contributed largely to various reviews and magazines, when he joined the *Athenæum,* of which he became editor in 1830. He reduced its price from a shilling to 4d (24 cents to 8 cents), enlisted the services of Lamb, Barry Cornwall, Sainte-Beuve and other prominent writers, thereby raising the expenses to the extent that there was no salary for himself — the editor. After 10 years' laborious work the *Athenæum* was an established success and in 1846 Dilke became business manager of the *Daily News,* of

which Charles Dickens was the first editor. Lack of unanimity among the proprietors led to Dilke's withdrawal after three years, when he devoted himself entirely to contributing to the *Athenæum,* in the columns of which his best work now began to appear. Among his more important contributions is his series of articles on the mystery of the Junius letters, in which he demolished the claims to their authorship advanced on behalf of Colonel Barré, Boyd, Sackville, Francis and several others. The essays are masterpieces of incisive criticism and quite as interesting as the famous "Letters" themselves. They were collected and published, together with his articles on Pope, Burke, Swift, Wilkes, Grenville, etc., in 1875 under the title of 'Papers of a Critic,' by Dilke's grandson, Sir Charles Dilke, in two volumes, prefaced with a memoir of their author. Consult also 'Dictionary of National Biography' (Vol. 15, London 1888).

DILKE, Sir Charles Wentworth, 1st baronet, English politician: b. 1810; d. Saint Petersburg, Russia, 10 May 1869; son of Charles Wentworth Dilke (q.v.). He was connected with the Royal Horticultural Society and the Royal Society of Arts. He is best known as one of the promoters of the great International Exhibition held in London in 1851, for which purpose the famous Crystal Palace (now at Sydenham, London, S.E.) was originally erected in Hyde Park. He came to New York in 1853 as commissioner to the Industrial Exhibition and went in a similar capacity to the Paris Exposition of 1855. Dilke was knighted in 1862 and appointed one of the five commissioners for the exhibition of that year. His parliamentary career was unimportant; he represented Wallingford as a Liberal 1865–68. He was in Russia acting as commissioner at an exhibition when he died. He was succeeded in the baronetcy by his son Sir Charles W. Dilke, M.P., the well-known statesman (q.v.).

DILKE, Sir Charles Wentworth, M.P., 2d baronet, English statesman and author: b. London, 4 Sept. 1843; d. there, 26 Jan. 1911. Eldest son of the first baronet of that name and grandson of the critic, C. W. Dilke (q.v.). Educated at Trinity Hall, Cambridge, he was graduated with honors and called to the bar in 1866; member Parliament for Chelsea 1868–86; Under-Secretary of State for Foreign Affairs, 1880–82; president of Local Goverment Board 1882–85; chairman of the Royal Commission for Negotiations with France, 1880–82; chairman of the Royal Commission for Housing of the Working-class, 1884–85; chairman of the Select Committee on Income Tax, 1906. He traveled in Canada and the United States in 1866; thence to Panama, New Zealand, Australia and Tasmania, studying the colonies at first hand, returning home across Ceylon, India and Egypt. On his return he published 'Greater Britain: a Record of Travel in English-speaking Countries during 1866–67' (2 vols., 1868). The work instantly took its place as a classic, passing through numerous editions in Great Britain and America. Inheriting the *Athenæum* from his father and grandfather, he also became proprietor of *Notes and Queries,* devoting himself to editorial work for a time. His reelection to Parliament was opposed in 1874 on the ground that he openly avowed his preference for a republican form of government, but he retained his seat. In 1875 he made another tour of the world, this time including China and Japan in his itinerary. His strong predilection for France gained him the friendship of many public men in that country.

Though nominally a Liberal in politics, Dilke leaned to the radical section of the party. How he first obtained office is told in Lord Morley's 'Life of Gladstone.' In the formation of his second administration in 1880 Gladstone had already distributed all the great posts among the "patrician whigs," when he was warned not to overlook the radical leaders. He sent for Dilke, who promptly refused to serve unless either himself or Chamberlain (the late Joseph) were in the Cabinet and that the other would then accept a subordinate post.

In the end Chamberlain was chosen and placed at the Board of Trade, and Dilke became under-secretary to the foreign office, a post not involving a seat in the Cabinet. Between 1880 and 1885 he held the various positions mentioned above. After the collapse of the Gladstone ministry in June 1885, Dilke came out of office — never to return, for in February 1886 fell the tragedy that blasted his political career, the Crawford divorce case. His resignation was inevitable; in his valedictory address to his constituents he said . . . "I can only assure you . . . as I have already often assured you, and with equal solemnity sworn in court, that I am innocent of the charges brought against me. . . ." Dilke had been a widower since 1874; in 1885 he married the widow of the Rev. Mark Pattison. She was in India at the time the scandal became public and directly showed her confidence in his innocence by announcing their engagement. In 1892 he returned to public life as Liberal member for the Forest of Dean division of Gloucestershire, which seat he retained till his death. He had spent the intervening years in literary activity, a recluse from society, yet supremely happy in his domestic life and the small circle of friends who remained by his side. His speeches were invariably listened to with respect by both sides of the House; he spoke with authority on numerous questions, colonial and foreign affairs, imperial defense, finance, social and labor problems. A wealthy man, he possessed one of the most interesting private collections in London, including many personal relics of Keats. In addition to the work already mentioned, he wrote 'New America' (1868); 'The Fall of Prince Florestan of Monaco' (1874); 'The Present Position of European Politics' (1887); 'The British Army' (1888); 'Problems of Greater Britain' (1890); 'Imperial Defence'; 'The British Empire' (1898); and a memoir of his wife prefixed to her 'Book of the Spiritual Life.' Consult the 'Life' of S. Gwynn and Miss G. Tucker.

DILL, Ludwig, German painter: b. Gernsbach, Baden, 2 Feb. 1848. He studied architecture and engineering, but soon abandoned these and took up painting under Raab, Seitz and Piloty at the Munich Academy. At first his work showed the influence of the Barbizon school, but afterward was greatly influenced by Baisch. To his early period belong large

marines and fishing scenes painted on the island of Chioggia, of which 'Sirocco,' in the Mannheim Gallery, is a noteworthy example. He paid a visit to Holland and returned to Munich, thereafter spending part of each year at Dachau. He now confined himself to pure landscape. His best works are 'Meadows' (Pittsburgh Gallery); 'Sacred Grove' (Munich); 'A Brook in the Moor' (Dresden); 'A Corner of the Giudecca' (1910); 'A Canal at Chioggia' (Mühlhausen); 'November Evening' (1912). In 1897, with Hölzel and Langhammer, he founded the so-called "Dachau Group." He was one of the judges at the Chicago and Paris expositions and later was appointed professor at the Karlsruhe Academy. Consult Rössler, 'Neu-Dachau' (Bielefeld 1905).

DILL, Sir Samuel, British educator: b. 26 Jan. 1844. He was educated at Queen's College, Belfast, and at Lincoln College, Oxford, and in 1869 became lecturer at the latter. He was Fellow, dean and tutor of Corpus Christi College 1869–77, headmaster of the Manchester Grammar School 1877–88. After 1889 he was commissioner of intermediate education, Ireland, member of the Belfast University Commission and prochancellor of Queen's University. In 1913 he became chairman of the vice-regal committee on primary education. He has published 'Roman Society in the last Century of the Western Empire' (1898; 3d ed., 1910); 'Roman Society from Nero to Marcus Aurelius' (2d ed., 1912), a standard work in its field.

DILL, (*Anethum graveolens*), the common name for an aromatic plant of the carrot family (*Umbelliferæ*). It is a native of Spain, but has been naturalized throughout the civilized world, where the climate is suitable for its growth. It is a particular favorite with the German people, who use it to flavor cucumber pickles, and therefore try to raise it wherever they may be living. In England it is used for the manufacture of gin, and to a small extent in medicine, as a carminative for children. An East Indian species is one of the ingredients in curry powder. It is a hardy biennial plant, growing upright. It has a single slender stem and leaves finely divided or pinnatifid. The flowers, which form an umbel, appear in June or July. The seed is of an oval form, convex on one side, flat on the other, having three striæ on the outside, and surrounded with a small membranous border. Its taste is slightly acrid, and its odor stronger but less pleasant than that of fennel, to which it is closely allied. In America, where found out of gardens, it is a fugitive from cultivation and is generally called fennel.

DILLENBURG, Prussia, capital of the circle of Dill Hesse-Nassau on the Dill, 20 miles southwest of Marburg. William of Orange, Liberator of the Netherlands, was born in the castle here in 1533. The site of the castle is now occupied by the Wilhelmsthurm, a tower 130 feet high. Iron mining and leather tanning are the principal industries. A mining school is located here. Pop. 5,371.

DILLENIACEÆ, dil-lē-nī-ā'sē-ē, a family of plants found chiefly in Australia, Asia and the warm parts of America. Sepals five, persistent; petals five, deciduous, in a single row; seeds universally arillate; stamens indefinite, hypogynous. The species are trees, shrubs or undershrubs. The Indian species are remarkable for their beauty, the grandeur of their foliage and the magnificence of their flowers. They have astringent properties, and some of the species afford excellent timber. The family consists of 13 genera and about 300 species.

DILLENIUS, dil-lā'nē-oos, or **DILLEN, Johann Jakob,** yō'hän yä'kōb, German botanist: b. Darmstadt 1687; d. Oxford, England, 2 April 1747. He was distinguished for his investigations into the propagation of plants, particularly cryptogamous plants. In 1721 he went to England, where he became first Sherardian professor of botany at Oxford and published several works, particularly 'Hortus Elthamensis' (1732) in which the drawings prepared by himself are distinguished by the greatest faithfulness. His last work, on the mosses, 'Historia Muscorum' (1741) added much to his reputation and was for long a standard book.

DILLER, Joseph Silas, American geologist: b. Plainfield, Pa., 1850. He was educated at Harvard University and at Heidelberg, Germany. He was geologist to the Assos expedition in 1881–83, and in the latter year became a member of the staff of the United States Geological Survey. His writings are very numerous, dealing principally with the Pacific coast region; they include 'Geology of the Lassen Peak District' (1889); 'The Coos Bay Coal Field' (1899); 'Geology and Petrography of Crater Lake National Park, Oregon,' with the cooperation of H. B. Patton (1902).

DILLINGEN, Bavaria, town on the Danube, 25 miles northwest of Augsburg. It contains many fine buildings, including the palace, royal gymnasium, a library of 75,000 volumes, a monastery, a Franciscan nunnery. The university founded here in 1544 became one of the strongholds of the Jesuits, was suppressed in 1804 and is now a royal lyceum. The town has manufactories of cutlery, cloth, paper and twine. Agriculture is also an important industry. The town was the seat of the counts of Dillingen during the Middle Ages. From 1286 to 1803 it belonged to and was the residence of the bishops of Augsburg. In the latter year it came into the possession of Bavaria.

DILLINGHAM, William Paul, American statesman: b. Waterbury, Vt., 12 Dec. 1843. He studied law, was admitted to practice in 1867, and was State attorney, Washington County, Vt., 1872–76. He was a member of the Vermont legislature 1876 and 1884; State senator 1878 and 1880; commissioner of State taxes 1882–88 and governor of Vermont 1888–90. Since 1890 he has been president of the Waterbury National Bank. He was elected United States senator in October 1900 to fill a vacancy caused by the death of Justin S. Morrill, and was re-elected for the terms 1903–09, 1909–15, 1915–21. In 1907 he was chairman of the United States Immigration Commission.

DILLMANN, Christian Friedrich August, German Orientalist: b. Illigen, Württemberg, 25 April 1823; d. 4 July 1894. He was educated in Tübingen and became lecturer there in 1852. In 1854 he accepted a call to Kiel, where he became professor of Oriental languages in 1860, but was transferred in 1864 to the chair of Old Testament exegesis at Giessen, which in 1869 he resigned to become Hengstenberg's successor at Berlin. In 1877 he became a member of the

Royal Academy of Sciences. Dillmann was beyond question the first authority in Europe on the Ethiopic languages. The best books for the student in this department of learning are his 'Ethiopian Grammar' (1857, revised by Bezold 1899); 'Ethiopian Dictionary' (1865); and his 'Ethiopian Selections' (1866). Other works (1879–84) deal with the history of the Ethiopic kingdom of Axum. He also wrote commentaries on Job (1869; 4th ed., 1891); Exodus and Leviticus (1880; 3d ed., 1897); Genesis (1875; English ed., 1897); Numbers, Deuteronomy and Joshua (1886), and Isaiah (1891). Other works are 'Ursprung der alttestamentlichen Religion' (1865); 'Die Propheten nach ihrer politischen Wirksamkeit' (1868), and 'Vorlesungen über Theologie des Alten Testaments' (1895). Consult brief biography by Baudissin (Leipzig 1895).

DILLON, John, Irish politician, son of John Blake Dillon, who was a prominent member of the Young Ireland party and member of the British Parliament for County Tipperary in 1865–66: b. New York 1851. He early identified himself with the Parnellite movement and in 1880 was elected to Parliament for County Tipperary. In the House of Commons Dillon soon became prominent for the violence of his language, while speeches delivered by him in Ireland led to his imprisonment in 1881, 1882 and 1888. From 1883 to 1885 he was absent from political life on account of ill-health, but in the latter year he reappeared and was elected for East Mayo, which he has since continuously represented. He was one of the most prominent promoters of the "Plan of Campaign." In 1896 he succeeded Justin M'Carthy as chairman of the main section of the Nationalist party, continuing until 1898. In 1901 he accepted the leadership of Mr. John Redmond in the reunited Nationalist party and since that date has been one of the most active of his lieutenants.

DILLON, John Forrest, American lawyer: b. Montgomery County, N. Y., 25 Dec. 1831; d. Far Hills, N. J., 5 May 1914. Going to Iowa in early youth he was graduated at the medical department of the Iowa University, but soon gave up medical practice and studied law, being admitted to the bar in 1852. He was State prosecuting attorney 1852–58; judge of the Supreme Court of Iowa 1863–69; and judge of the United States Circuit Court, Eighth Judicial District, 1869–79, when he resigned. From 1879–82 he was professor of real estate and equity jurisprudence in Columbia Law School and became prominently known as a railroad lawyer, being general counsel of the Missouri Pacific Railway Company and the Western Union Telegraph Company, and consulting counsel of the Manhattan Elevated and Pacific Railway companies. Among his works are 'United States Circuit Court Reports' (1872); 'Municipal Corporations' (1872); 'Removal of Causes from State to Federal Courts' (1877); 'Municipal Bonds' and 'Laws and Jurisprudence of England and America' (1894); 'John Marshall' (3 vols., 1903); 'Commentaries on the Law of Muni-Corporations' (revised and enlarged, 1911).

DILOLO (dē-lō'lō) **LAKE,** Central Africa, a small body of water discovered by Dr. Livingstone (1854). Its altitude is nearly 5,000 feet above the sea. It is supposed to be connected with both the Zambesi and Kongo rivers, as it lies on the watershed between these two river systems. Its location is in lat. 11° 30′ S., long. 22° 30′ E. Hippopotami and fish abound in its waters.

DILTHEY, dĕl'ti, **Wilhelm,** German philosopher: b. Biebrich, 1834; d. 1911. He received his education at the universities of Heidelberg and Berlin and in 1866 became professor of philosophy at Basel, removing to Kiel two years later in a similar capacity, to Breslau in 1871 and to Berlin in 1882. He published 'Das Erlebnis und die Dichtung' (1906). He is best known, however, by his attempt to set psychology as the basis for scientific research in history and sociology and ignoring metaphysics. This plan or system is outlined in his 'Einleitung in die Geisteswissenschaften' (1883).

DILUENTS, remedies that increase the proportion of fluid in the blood. They are employed in fevers to lessen thirst and increase secretion, and are used in certain acrid affections of the stomach and intestinal regions. Water is the only real diluent, though it may be given in various forms — soups, barley-water, toast-water, milk, lemonade, soda water, beer, tea.

DILUVIUM, a term first used by the English geologist Buckland in 1823, and applied by him to the deposits between the Tertiary system and those now in process of formation. He regarded them as the discharge from a universal flood. The diluvium thus includes the boulders, sands and clays which Lyell included under the name Pleistocene and Morlot under the name Quaternary. Though the term diluvium is no longer used, the adjective diluvial is still employed, especially by foreign geologists, to designate accumulations of gravel or angular stones formed during the Pleistocene period. See GLACIAL PERIOD; PLEISTOCENE; QUATERNARY.

DIME (Fr. *dîme,* contraction of *dixième*), a silver coin of the United States of the value of 10 cents, or one-tenth of a dollar. It was first coined in 1796 in pursuance of the act of 2 April 1792, though pattern pieces were struck in 1792. Its legal standards have been as follows: By act of 2 April 1792 fineness 892.4 thousandths, weight 41.6 grains; by act of 18 Jan. 1837 fineness 900 thousandths, weight 41¼ grains; by act of 21 Feb. 1853 fineness 900 thousandths, weight 38.4 grains.

DIMENSIONS. See UNITS OF MEASUREMENT.

DIMINUTIVE, *in grammar* (Lat., *diminutivum*), a word formed by adding a suffix conveying the idea of littleness and other connected ideas, as tenderness, affection, contempt, etc. The opposite of diminutive is augmentative. In Latin, diminutives almost always end in *lus, la,* or *lum;* as *Tulliola, meum cordulum,* little Tullia, my dear or little heart.

The Italian is particularly rich in diminutives and augmentatives: *ino, etto, ello,* convey the idea of smallness, dearness, etc.; *one,* of largeness; *uccio,* sometimes of smallness, with reproach, but often without it; *accio* signifies that the thing is disgusting, unpleasing, etc.— for example, *casa* is a house; *casetta, casina, casella,* a small house, nice little house; *casone,* a large house; *casuccia,* a small, insignificant house; *casaccia,* an ugly house. That expressive tongue can compound two or three of these endearing affixes; and travelers may frequently hear little Italian children form almost endless words, as

if overflowing with tenderness; for instance, *fratellinucciettinetto*. Adjectives also can receive the diminutive termination; as *carino, carinuccio,* from *caro*. In Spanish there are similar diminutives, augmentatives and other affixes. Thus from *hombre,* a man, are formed the augmentatives *hombron, hombraso, hombronazo, hombrachon;* and from *mujer,* a woman, *mujerona, mujeraza, mujeronaza.* Diminutives in *ito* and *ico* usually denote endearment or tenderness, as those in *illo* do sometimes; those in *elo* always denote contempt. In Portuguese the diminutives and augmentatives correspond to those of the Spanish language. In French there are many diminutives formed from other words; as, *tablette,* of *table, charette* of *char;* but there is no general affix which can be added to every substantive. The German has the syllables *chen* (in Low German, *ken,* with which corresponds the English *kin,* as in *manikin,* and some other words), *lein* and *el,* for substantives; *lich,* etc., for adjectives; *lich* corresponds to the English *ish* or *like;* for instance, *rundlich,* roundish or roundlike (from *rund,* round). The German even adds the diminutive to pronouns, and nurses will sometimes say *duchen,* from *du,* thou.

The English language affords examples of diminutives, but has no affix which can be used at pleasure to convey this idea. Those commonly used are *ock, kin, el, ling* and *et;* as in bullock, lambkin, kernel, gosling and tablet. Diminutives of proper names are also formed, in colloquial and familiar language, by adding *y* or *ie* to the names, as *Charley, Johnny,* etc.

DIMITY (Gr. *di-* double, *mitos,* thread; literally, made with a double thread), a stout cotton fabric, ornamented in the loom either by raised stripes or fancy figures; stripes are the most common, as the mounting of the loom is much simpler and the texture can be produced at less expense. The figure or stripe is raised on one side and depressed on the other, so that the two faces present reversed patterns. It is rarely dyed, but usually employed white, as for bed and bedroom furniture. There is also a much finer cotton stuff on the market to-day which is manufactured for summer dress material. The fabric was first made in Spain, and as early as 1643 was manufactured in the Massachusetts Bay colony.

DIMMESDALE, dim'dāl, **Arthur,** the erring clergyman in Nathaniel Hawthorne's tale, 'The Scarlet Letter.' See SCARLET LETTER, THE.

DIMORPHISM (from the Gr. *dimorphos,* of double form), in crystallography, the crystallization of a body in forms belonging to two different systems, or in incompatible forms of the same system. In biology, the occurrence of individuals of the same species in such a form, that, were not their relation known, they might be considered as separate and distinct in species and even in genera. Thus in sexual dimorphism, the male and female of the same species present distinct characters, the male may be winged, the female wingless. See EVOLUTION; POLLINATION.

DIMORPHODON, the oldest known genus of the Ornithosauria, allied to the pterodactyl, and found as a fossil in the Liassic rocks near Lyme Regis, in the south of England. The large head has powerful jaws, with large anterior teeth which are pointed, and small posterior teeth which are lancet-shaped. The legs are long and slender with the fourth fingers of the four limbs greatly elongated to support the membranous wings. This is the earliest of the reptiles that were capable of flight. See PTEROSAURIA; PTERODACTYL.

DIMSDALE, Thomas, English physician: b. Theyden-Gernon, Essex, 6 May 1712; d. Hertford, 30 Dec. 1800. He was educated at Saint Thomas's Hospital, and practised medicine at Hertford. He published 'The Present Method of Inoculation for the Smallpox' (1767). He was famous as an inoculator, making journeys in 1768 and 1784 to Russia to inoculate the Empress Catharine and other magnates. For this service he received $50,000 and an annuity, together with other valuable gifts. In 1784 he also visited the courts of Berlin and Vienna. His works include 'Thoughts on General and Partial Inoculation' (1776); 'Observations on the Plan of a Dispensary and General Inoculation' (1780); 'Tracts on Inoculation' (1768, 1781).

DINAH, in the Biblical account (Gen. xxxiv) a daughter of Jacob and Leah, who was violated by Shechem, whose people adopted circumcision and formed an alliance with the Israelites. This alliance, however, availed them little for they were set upon and slain by Simeon and Levi, sons of Jacob and brothers of Dinah. Some biblical scholars claim that Dinah is the name of a clan, which by intermarriage with the Shechemites aroused the enmity of the tribes of Simeon and Levi and were murdered by them. Other scholars maintain, however, that such a reading of the text is far from justified. Consult Meyer, Ed., 'Die Israeliten und ihre Nachbarstämme' (1906) and Wellhausen, 'Israelitische und jüdische Geschichte' (7th ed., 1914).

DINAH MORRIS, the heroine of George Eliot's novel, 'Adam Bede' (q.v.). She is a factory girl and at the same time a lay preacher whose purity, spirituality, strength and tenderness have an uplifting influence on all who come in contact with her. The beauty of her character is especially developed in her intercourse with the guilty and condemned Hetty Sorrel. Elizabeth Evans, an aunt of George Eliot, appears to have been the original from whom the character was drawn.

DINAN, dē-nän' (ancient DINNANUM, fortress on the water), a town in the department of Côtes-du-Nord, France, on the Rance, 16 miles south of Saint Malo and 30 miles northwest of Rennes. The town is built on the summit of a granite cliff, 250 feet above the river, which is crossed by a fine stone viaduct 130 feet high and about 800 feet long. The remains of the ancient town walls are still to be seen and there are here also the interesting ruins of an ancient castle. The older portion of the town has narrow, crooked streets, but many of the buildings are picturesque. The town has a museum and the cathedral is of considerable interest. There are manufactories of agricultural implements, linen, sailcloth, cotton and woolen goods, cider, beet-sugar and barges. The town's trade is considerable. Dinan dates from the Celtic period (witness its name derived from the Celtic *dun,* fortress, *abain,* of the water). It was besieged by the English

under Lancaster in 1359, was then captured and later retaken by DuGuesclin. Consult Bazouge, 'Guide du voyageur dans la ville de Dinan et ses environs' (Dinan 1875). Pop. 11,410.

DINANT, dē-nāṅ' or dē-nänt', Belgium, a town in the province of Namur, picturesquely situated on the Meuse, 17 miles south of the city of Namur. Notable buildings are the church of Notre Dame, an ancient and richly decorated structure, and the city hall, once the palace of the princes of Liége. The town contains sawing-mills for working the black marble found in the vicinity; paper mills, carpet factories, breweries, tanneries, factories for the production of metal-wear and glassworks. In the Middle Ages, Dinant was famous for its copperware, or "dinanderie." The town was fortified as early as the 12th century. In 1466 Philip the Good, Duke of Burgundy, besieged it with 50,000 men; and having taken it by assault, razed it to the ground and threw 800 of its inhabitants, tied in pairs back to back, into the Meuse. In 1554 and again in 1675 it was captured by the French. On account of its quaintness and the beauty of its natural surroundings Dinant had long been a popular summer resort. The town suffered severely in the European War.

On 15 Aug. 1914 an engagement was fought in the vicinity between French and German troops. More fighting occurred on 22 and 23 August. On the 21st the Germans began setting fire to the houses; batches of inhabitants were driven through the flaming streets at the point of the bayonet, with their hands held above their heads; hundreds were shot or bayonetted. According to the Bryce Report (q.v.), "unarmed civilians were killed in masses . . . about 90 bodies were seen lying on the top of one another in a grass square opposite the convent." It was also stated that 60 corpses of civilians were recovered from a hole in the brewery yard and that 48 bodies of women and children were found in a garden. The town was systematically set on fire by hand grenades. . . . The shooting of inhabitants, women and children as well as men, went on after the Germans had passed Dinant on their way into France. The houses and villages were pillaged and property wantonly destroyed." A little tourist steamer on the Meuse was used to collect pianos, pictures, clocks and pieces of furniture from the villas lying on the river banks (Jean Massart, Royal Academy of Belgium).

At Fonds de Leffe, a suburb of Dinant, the population left behind comprised 251 men and boys. They were taken away on 23 Aug. 1914. Of these, eight escaped and 243 were put to death next day. The population of Dinant before the war was about 8,000. Consult Hachez, 'Histoire de Dinant' (1894–96); Massart, J., 'Belgians under the German Eagle' (London 1916); Pirenne, 'Histoire de la constitution de la ville Dinant au moyen âge' (Ghent 1889); Remacle, 'Inventaire des archives de la ville de Dinant' (Dinant 1880–83).

DINAPAC, GUINAPAC, ROCKS, Philippines, two tower-like rocks, lying east of Camiguin Island, north of Luzon. On 2 Nov. 1899, the United States ship *Charleston* struck an uncharted coral reef three miles north of Dinapac Rocks and was totally wrecked.

DINAPUR, dē'nä-poor, India, city in the district of Patna, province of Behar and Arissa, British India, on the Ganges, about 12 miles northwest of Patna. It is one of the great stations of the British army in India. In 1857 it was the scene of the mutiny of three Sepoy regiments. It has cabinet factories, iron foundries and oil presses. Pop. 31,025.

DINAR, dē-när' or dī'nėr (Lat. *denarius*), formerly an Arab gold piece weighing about 65.4 grains troy. Also a Persian money of account worth about 1/125 cent. It is now the name of the chief Serbian coin, value one franc.

DINARCHUS, Greek orator: b. Corinth, 361 B.C.; d. Athens, 291 B.C. He studied under Theophrastus and was most successful during the reign of Demetrius Phalereus (317–307). After the fall of Demetrius he fled to Chalkis and returned to Athens in 292 B.C. Of his speeches, of which there were probably about 60, only three are preserved; these are entitled 'Against Demosthenes'; 'Against Aristogeiton' and 'Against Philocles.' They were spoken during the prosecution of these three on a charge of accepting bribes from Harpalus. Consult Blass, 'Attische Beredsamkeit' (Leipzig 1893); and the editions of the speeches by Mätzner, text and commentary (Berlin 1842) and by Thalheim (ib. 1887).

DINARD, dę'när, or **DINARD-SAINT ENOGAT,** France, the capital of a canton, in the department of Ille-et-Vilaine, opposite Saint Malo, on the estuary of the Rance. It is a modern town, picturesquely situated on a rocky promontory and is the most fashionable sea-bathing resort in Brittany. It has beautiful villas and summer cottages and is greatly frequented by tourists. Pop. 7,003.

DINCKLAGE-CAMPE, dink'läg-ė-käm'pė, **Amalie (Emmy) von,** German novelist: b. Campe, Osnabrück, 13 March 1825; d. Berlin, 28 June 1891. Her first novel, 'The Loving Old Couple,' was published in 1857. Though she traveled extensively and observantly in Europe and America, her themes for stories were nearly all from her own countryside and she is called "the poetess of the Ems valley." Among her works are 'The School of the Heart'; 'Tales of Home'; 'Pictures of Emsland'; (posthumously) 'Poems'; 'Young Alaric's Bride' (1890); a story, 'The Woman Nihilist' (1893).

DINDINGS, The, a British possession belonging to the Straits Settlements, consisting of the island of Pangkor and a strip of land on the coast of Perak on the west side of the Malay Peninsula; area about 200 square miles. See STRAITS SETTLEMENTS.

DINDORF, Karl Wilhelm, German classical scholar: b. Leipzig, 2 Jan. 1802; d. there, 1 Aug. 1883. He became in 1828 professor of literary history at Leipzig, but resigned in 1833 in order to devote himself entirely to literary work. He contributed to the edition of Aristophanes by Invernizzi and Beck (1820–34), and between 1835 and 1839 published at Oxford an edition of the same poet. Other works by him are editions of Æschylus (1841–51); Euripides (1834–63); Sophocles (1832–36); and Demosthenes with notes and the Greek scholia (Oxford 1846–51); 'Lexicon Sophocleum' (1871); 'Lexicon Æschyleum' (1873–76); and a new edition of Stephens' 'Thesaurus Linguæ Græcæ' (1831–65). He edited several Greek historians

for Niebuhr's collection of Byzantine writers. Dindorf ranks among the leading Hellenic scholars of the 19th century. Consult Sandy, 'A History of Classical Scholarship' (Vol. III, Cambridge 1908).

DINDYMENE. See CYBELE.

DINEIR, dē-nā-ēr', or **GEYIKLAR,** Asia Minor (the ancient CELÆNÆ), a town in the province of Aidin, close to the headwaters of the Mæander River. It lies at an altitude of 2,845 feet and commands the road from the Lycus Valley to the interior. Because of this Celænæ was at an early period an important centre of commerce and civilization. After long centuries of decline modern railway construction is again operating in its favor. It is now the easternmost terminal of the Aidin Railway from Smyrna and a railway is projected from Adalia north to Dineir. These roads would greatly enhance its commerce, as it is in the heart of a rich agricultural district. It has manufactories of flour. Many of the houses are partly constructed of blocks of marble from the ruins of the ancient town. Pop. 2,000, the majority of which are Turks.

DINGELSTEDT, Franz von, BARON, German poet and dramatist: b. Halsdorf, Upper Hesse, 30 June 1814; d. Vienna, 15 May 1881. His 'Songs of a Cosmopolitan Nightwatchman' (1841) shocked all officialdom, but had a great popular success; and his 'Poems' (1845) showed true poetic feeling and great descriptive power, the latter also visible in his travel sketches and stories; one of the most successful of the latter is 'The Amazon,' a society novel. His tragedy 'The House of the Barneveldts' (1851) was a splendid success. He adapted plays from Molière, Shakespeare and others to the German stage and wrote a volume of 'Studies and Copies After Shakespeare' (1858). He was a successful theatrical director at Munich, Weimar and Vienna; was ennobled in 1867 and made baron in 1876. In 1877 a complete edition of his works was issued in 12 volumes. Consult his autobiography, entitled 'Münchner Bilderbogen' (1879).

DINGLE, Philippines, a city of Panay, in the province of Iloilo, on Jalaur River, 18 miles north of the city of Iloilo. It was founded in 1825. There are gold deposits in the vicinity. Pop. 12,129.

DINGLEY, Nelson, American legislator and journalist: b. Durham, Me., 15 Feb. 1832; d. Washington, D. C., 13 Jan. 1899. He was graduated from Dartmouth College in 1855; admitted to the bar in 1856; purchased the Lewiston *Journal* in 1856; edited a daily edition in 1865 and was its editor and proprietor till his death. He was elected to the State legislature in 1861; served in that body till 1865 and in 1868 and 1873, and was speaker of the house in 1864–65. He was elected governor of Maine in 1873 and re-elected in 1874 and was a member of Congress from 1881 till his death. From the beginning of his congressional career he was conspicuous as an advocate of the principle of protection and was author of the Dingley Tariff Bill of 1897. In 1908 he was appointed a member of the Joint High Commission on controversies between Canada and the United States.

DINGO, the Australian wild dog (*Canis dingo*), the only species of dog known to exist in both the wild and the domesticated states and also the only carnivorous placental mammal in Australia. It is sometimes considered as being of Asiatic origin, the theory being that it was brought to Australia by the first men who came there, and that it has since become wild. The finding of its remains in the Quaternary strata of Australia and in Pleistocene cavern deposits apparently disposes of this theory. It is not found in Tasmania or New Zealand, in which the fauna is generally like that of Australia. The dingo has decreased in numbers, retreating before the advance of civilization and suffering from the war made upon it by the settlers, whose flocks it preys upon. The animal is about two and a half feet long and nearly two feet high; has large erect ears and a bushy tail. It is tawny in color; some specimens, however, being pale and others almost black. In the wild state it is especially crafty and courageous and hunts in packs sometimes containing 100 dogs. The native Australians seek the young dingoes and having taken them from the lairs where they are found, bring them up as domestic animals. When well treated they are affectionate and trustworthy and are used to help their masters in hunting the animals on which the natives live — opossums, snakes, lizards, etc. While the domesticated dingo is his friend and companion, the native Australian will hunt the wild dog, kill him and, having roasted him, will eat him with a keen appetite. Consult Lydekker, 'New Natural History' (Vol. I, 1897); Smyth, 'The Aborigines of Victoria' (Melbourne 1878); Wheelwright, 'Bush Wanderings' (London 1865). See DOG.

DINGRAS, dēn-grās', Philippines, city in the province of Ilocos Norte, in Luzon, 11 miles southeast of Laoag. It is on the Grande de Laoag River. It is situated in a fertile plain, surrounded by mountains, which is subject to inundations. Dingrás was founded in 1598. Pop. 15,792.

DINGWALL, Scotland, a royal burgh and county town of the united counties of Ross and Cromarty, at the head of the Cromarty Firth, 18 miles northwest of Inverness. A short canal enables vessels of light draught (9 feet) to come up to the town. Nearby are traces of the ancient castle of the earls of Ross. The town lies low, in the midst of a rich, fertile and well-wooded ground. The sulphur springs of Strathpeffer lie five miles to the westward of the town. Pop, 2,639.

DINIAS and **DERCYLLIS,** characters in an old Greek novel, in 24 books, no longer extant, with the title, 'Incredible Things in Thule.' The author was a Syrian, Diogenes Antonius, who lived about the 2d century of our era. The work was used as a source by many later writers.

DINICHTHYS, dī-nīk'this, (Gr. *δεινός*; terrible; *ἰχθύς* fish), a genus of enormous fossil fishes found in Carboniferous and Devonian rocks. They are usually classed with the Dipnoi (q.v.) as members of the order *Arthrodira*. The body is estimated to have been from 15 to 18 feet in length. Its general shape closely follows that of the *Coccosteus*. The head, often 3 x 4 feet, was composed of heavy plates well joined

together. The eyes were large and the teeth were formidable. There is a hinge joint between the head plates and the body plates. A great number of these fossils have been dug out of the Upper Devonian shale of Ohio. The best-known species are *Dinichthys hertzeri* and *D. terrelli*. Consult Dean, 'Fishes, Living and Fossil' (New York 1895); id., "Contributions to the Anatomy of Dinichthys," in 'Transactions' of the New York Academy of Sciences (Vol. XV, 1896; Vol. XII, 1894; and Vol. XVI, 1898); id., "Studies on Fossil Fishes" in 'Memoirs' of the American Museum of Natural History Vol. IX, New York 1900); Newberry, "The Palæozoic Fishes of North America," in 'Monograph' of the United States Geological Survey (Vol. XVI, Washington 1890).

DINIZ DA CRUZ E SILVA, dē'nēs dä kroos ē sēl'vä, **Antonio,** Portuguese poet: b. Lisbon, 4 July 1731; d. Rio de Janeiro, Brazil, 5 Oct. 1799. A lawyer and official, in 1776 he was made counsel to the Superior Court at Rio de Janeiro. He was one of the founders of the celebrated literary society, the Arcadia Lusitana. His poetry comprises sonnets, eclogues, elegies, songs, epigrams, epistles and several volumes of Pindaric odes; a lengthy poem, 'Brazil's Metamorphoses'; and a heroi-comic epic, 'Hyssop,'—modeled on Boileau's 'Lutrin,' but a spirited, original composition, far superior to Boileau's—which was republished several times in France, and translated into French prose. He is referred to as the "Portuguese Pindar." His odes are fine and local color pervades all his works. The 'Hyssop' pictures faithfully and graphically the vanities and intrigues of the society of a provincial town dominated by two cliques. Boissonade translated the work into French and it ran through two editions (Paris 1828, 1867). Selections have appeared in English in the *Foreign Quarterly Review* and in the *Manchester Quarterly*. The work was edited by J. R. Coelho (Lisbon 1879), with introductory study of the poet and his works. His collected works, 'Poesias,' were issued at Lisbon (1807–17).

DINIZULU, last king of Zululand: b. 1869; d. Transvaal, 19 Oct. 1913. He was the son of King Cetewayo (q.v.), after whose death in 1884 he was proclaimed king. The British annexed Zululand in 1887, when the regulations which came into force did not recognize the pre-eminence of Dinizulu, who nevertheless continued to act as king, ordering executions and imposing fines and taxes. Trouble ensued with the British government and the dusky monarch fled, but surrendered 15 Nov. 1888. Brought to trial, he was convicted of high treason and sentenced to 10 years imprisonment 27 April 1889. This was commuted to transporation to Saint Helena in 1890. He was allowed to return to Zululand in 1897, was given a house and a pension of $2,500 per annum. He was convicted of complicity in a rebellion in 1906, was fined $500 and given four years' imprisonment. He was released in 1910 and allowed to reside at Middleburg on his farm, where he died.

DINKA, a powerful tribe of Negritos who live on both sides of the White Nile between lat. 6° and 12° N. in the Egyptian Sudan. Their territory covers about 40,000 square miles. They are intelligent, have some skill in making articles for household use and also follow agriculture. Each village is governed by its own chief. Polygamy is practised. They are brave and of good physique and for these reasons many find their way to the Sudanese army. It is the common practice to extract the lower incisor teeth in both men and women. A good grammar of their language was written by Mitterutzner (Brixen 1866). Consult Gleichen, 'The Anglo-Egyptian Soudan' (London 1905); Kaufmann, 'Schilderungen aus Central Afrika' (Brixen 1862) and Schweinfurth, 'In the Heart of Africa' (Frewer's trans., London 1873).

DINKARD (the enactments of religion), an important compilation of information concerning the doctrines, customs and writings of the religion of Zoroaster, compiled shortly after the Mohammedan conquest of Persia. In its present form, much of the work is a descriptive list of the contents of a larger and earlier work. It has been edited, with English and Gujerati translation, by Peshotan Behramji Sanjana (Vols. I–XIII, Bombay 1874–1912).

DINOHYUS, a genus of gigantic, primitive, swine-like animals, some of which were six feet in height at the shoulders, found fossil in Lower Miocene rock of the western United States.

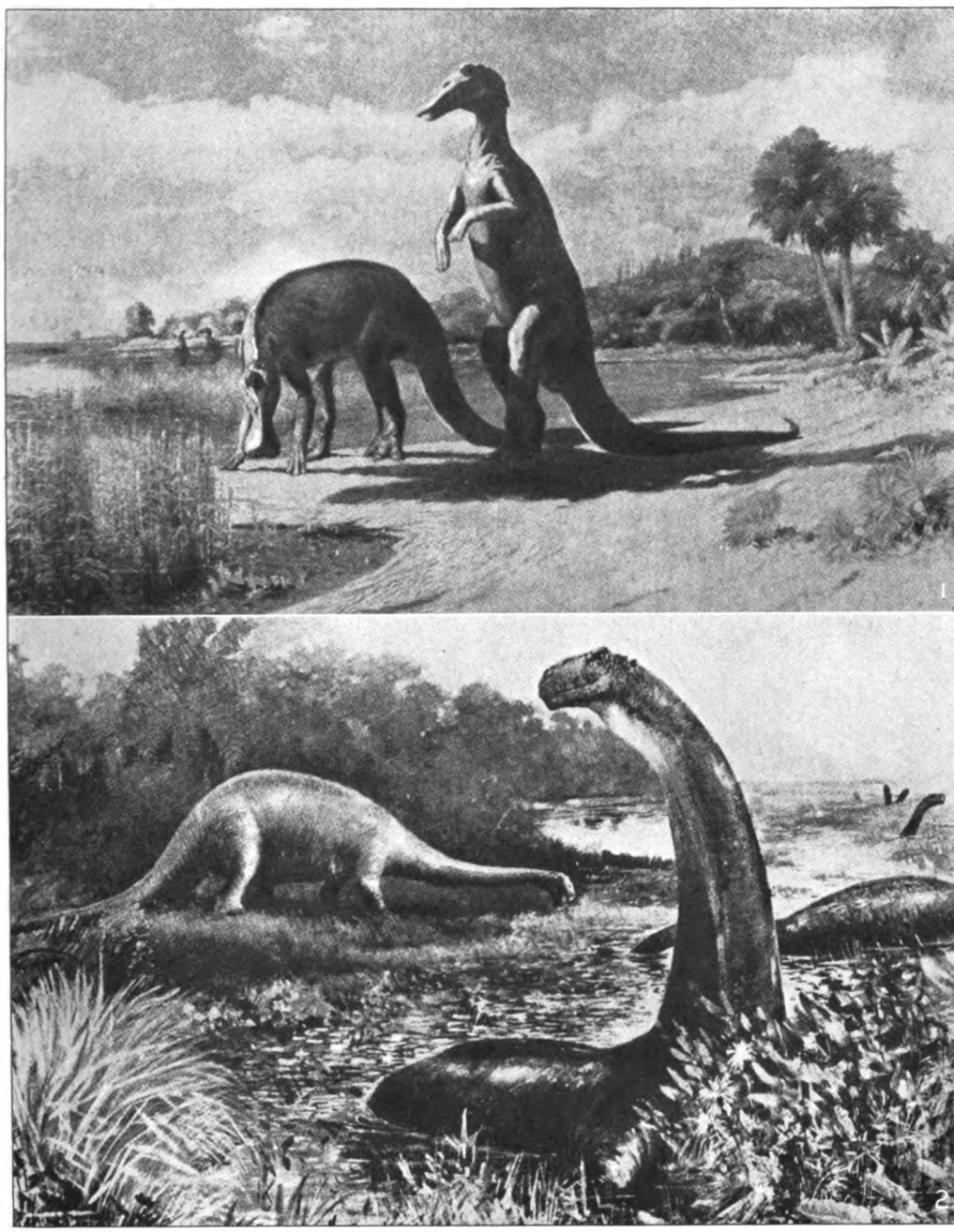
DINORNITHES. A group of extinct, flightless, ratite birds of gigantic size, the moas of New Zealand, with small heads, stout legs, the bones without air-passages, wings absent or extremely reduced, furculum absent and after-shafts large. The genera were *Dinornis, Pachyornio, Mesopteryx, Anomalopteryx* and *Megalopteryx*. See MOA.

DINOSAURIA. A group of reptilian animals which flourished during the Mesozoic Era, or the Age of Reptiles. They were in many ways the ruling or dominant forms of that time and as such filled the various rôles of terrestrial animals as do the warm-blooded mammals of to-day. Dinosaurs were air-breathing animals and, in common with other reptiles, such as the modern crocodiles, to which they were somewhat distantly related, possessed a more or less scaly or armored skin and were probably cold-blooded or poikilothermous, that is, possessing no mechanism for the maintenance of bodily heat, but having an internal temperature which varied with that of the outside air. It is assumed that they were egg-laying, but this can neither be proved nor disproved until either eggs or unborn young are found.

In their anatomy the dinosaurs show certain features which link them with the crocodiles on the one hand and with the birds on the other, and while due in part to community of habit, such as bipedal running on the part of dinosaurs and birds and the consequent modification of the hind limbs, these similarities of structure also imply genetic or blood relationships.

In size the dinosaurs ranged from that of a house cat to a length and bulk exceeded only by the greater of the modern whales—upward of 90 feet long and 40 tons in weight. In habits they were as varied as in size, for some were light of foot and bipedal while others were quadrupeds of unwieldy bulk, some armored, others armorless, some endowed with horns or with talons and terrible teeth, yet others

DINOSAURS



From a painting by Charles R. Knight

Courtesy of the American Museum of Natural History, New York

1 Trachodon — the duck-billed Dinosaur

2 Brontosaurus — an amphibious Dinosaur

whose only apparent means of defense lay in their huge size and inaccessible habitat. They were carnivorous and herbivorous, some of the latter having very defective dentition which made mastication of the food impossible, while others were provided with a dental battery of marvelous detail and perfection.

Their habitat was in all probability the land, at any rate at the beginning of their racial career; indeed, the initial stimulus to their evolution may well have been aridity of climate, which is generally an incentive to the development of traveling powers and hence may have brought about the cursorial adaptation which so distinguishes the earlier forms. Later the dinosaurs, at any rate such as are known to us, were inhabitants of low-land lying along the shores of seas and oceans and some were actually partly, if not wholly, water-living, although none show an extreme of adaptation to aquatic life and none were salt-water inhabitants, the occasional inclusion of their remains in marine strata being the result of accident.

There is reason to believe that the dinosaurs were diphyletic, that is, consisted of two races which ran separate though in many ways parallel evolutionary courses, the one group, the carnivores (Theropoda) and their plant-feeding derivatives (Sauropoda) being nearer the crocodiles, and the true herbivores (Predentata) being nearer the birds. It is probable, however, that each phylum was derived from the same ancestral stock, but that the divergence began at once, possibly in Permian time.

The duration of dinosaurian existence was immensely long, for their remains are first found in rocks of Middle Triassic time, but these are already in a state of development that implies a long antecedent evolution. And they continue, despite the extinction of certain lines, until the very close of the Mesozoic, a lapse of time measured by millions of years. Their fossils appear first in Germany, but this does not necessarily imply a Germanic origin; on the contrary, the belief has been expressed that one must go farther west to a continental mass which once linked Europe and North America across what is now the North Atlantic to find their ancestral home. Thence they spread the world over, their remains being found in Europe, North and South America, Africa, Madagascar and Australia; but, with the exception of India, they are as yet unknown from the great continent of Asia. Whether this is significant or merely because they have not thus far been discovered, is not known.

The classification of the dinosaurs may be given as follows:

COHORT DINOSAURIA:
Order Saurischia. Primitively carnivorous dinosaurs.
Suborder Theropoda. Bipedal carnivorous dinosaurs.
Suborder Sauropoda. Quadrupedal, amphibious, plant-feeding dinosaurs.
Order Ornithischia. Predentate or beaked herbivorous dinosaurs.
Suborder Ornithopoda. Bipedal unarmored dinosaurs.
Suborder Stegosauria. Quadrupedal armored dinosaurs.
Suborder Ceratopsia. Quadrupedal horned dinosaurs.

The two main phyla or orders of dinosaurs have received the rather cumbrous names of Saurischia (Gr. σαῦρος, lizard, and ἰσχίον, hip joint) and Ornithischia (Gr. ὄρνις, bird), because of the basic structure of their pelvis, which in the one case resembles that of the crocodile or saurian and in the other that of the bird, and, as has been said, there is evidence that the relationship thus implied is real. In many ways the two groups give evidence of having undergone closely parallel lines of evolutionary progress, especially in their method of locomotion and consequently in their motor organs. This is particularly true of the first suborder in each phylum, the Theropoda and Ornithopoda. Out of each of these more conservative stocks arose aberrant lines in which a premium was placed either on bulk (Sauropoda) or on armor (Stegosauria) or on weapons (Ceratopsia), with consequent modifications and specializations far removed from the primitive stock. Then, too, there was on the part of the two main orders the diametrically opposed dietary — flesh on the one hand, with its relatively simple dental and digestive mechanism, and vegetal food on the other, with a resultant complexity of dentition in the more highly specialized members which has never been surpassed.

Saurischia — *Theropoda.* The earliest known dinosaurs belong to the Saurischia, suborder Theropoda, and they existed with but little change until the close of the Mesozoic. They were bipedal, with four-toed, bird-like feet, armed with increasingly powerful claws, and with four-fingered hands provided with grasping talons. The skull was lightly constructed, somewhat bird-like in form, but possessing no beak. On the contrary, their powerful jaws were armed with a single row of teeth, often flattened, curved and dagger-like, with finely serrate margins which must have made them highly efficient for tearing and rending their prey, but not for mastication. The teeth were mainly in the forward portion of the jaws. The head was poised at right angles to the rather short neck and the compact trunk was followed by a long and often very slender tail which served to counterbalance the weight of the body and head when they were borne on the hind limbs in a semi-erect posture. From an exhaustive study of dinosaurian footprints which exist by the thousands impressed upon the Triassic rocks of the Connecticut Valley, one is justified in assuming that the fore feet were never brought into contact with the ground, although they doubtless were of use in fighting or in grasping the prey. There is as yet no direct evidence of the nature of their skin except on the sole of the foot, but we have no reason to suppose that it was other than reptile-like, clothed in all probability with a flexible scaly covering, but otherwise unarmored.

The Theropoda were highly conservative, increasing in general dimensions and consequent prowess, with the peculiar exception that in the larger forms, the megalosaurs, the hands failed to keep pace with the general increase in stature until in the final forms they were relatively so absurdly small that it is difficult to conjecture their use. But not all Theropoda were of this sort, for another group remained relatively small, agile forms until the end of their racial career. At least one of these (*Struthiomimus*) became entirely toothless — a sign of degeneracy, but in this instance coupled with an otherwise efficient body, which makes the interpretation of habits and habitat a matter of great doubt.

Some of the more notable genera were:

Anchisaurus, a primitive carnivorous dinosaur, some seven feet in length, from the Upper Triassic, known from several skeletons and numerous footprints from the Connecticut Valley and from New Jersey. See Fig. 1.

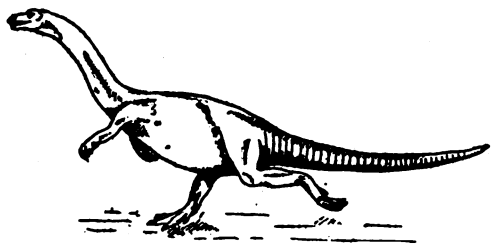


FIG. 1—Anchisaurus. 7 feet.

Allosaurus, a splendid type, with a length of 34 feet, more than half of which was included in the slender tail. This creature is from the Comanchian or Lower Cretaceous of Wyoming and the adjacent West and is represented in the Old World by a near ally, *Megalosaurus,* of wide distribution, both in time and space.

Tyrannosaurus, the terminal member of the race, 47 feet long, with the bodily bulk of an elephant, a great four-foot head, armed with teeth three to six inches in length, carried 20 feet in the air, relatively tiny hands, but huge feet which bore powerful claws. This creature, which has been most appropriately named, was the most appalling devourer of flesh which ever stalked abroad, but while admirably adapted and equipped to meet and overcome the unwieldy herbivores of its day, would find it difficult to make a living in these days of brainier, more agile mammals. See Fig. 2.

Accompanying their larger, fiercer kin in their evolutionary career were the smaller and more active carnivores, beginning with the slender *Podokesaurus* of the Triassic and with *Compsognathus* of the Jurassic, the smallest known dinosaur, and culminating in the toothless forms which we have mentioned. Their increase in size was gradual, and their slenderness and well developed grasping hands imply, except in the last mentioned, their adaptation to more agile and feebler prey.

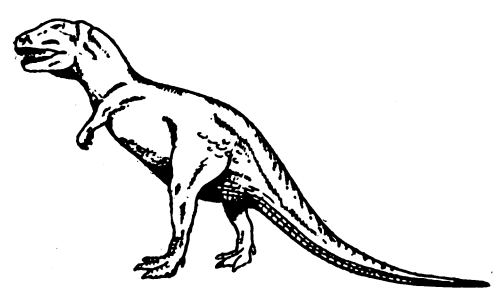


FIG. 2—Tyrannosaurus. 47 feet.

Sauropoda.—Another, relatively short-lived, race were the amphibious dinosaurs or Sauropoda, apparently derived from the theropod group, but departing widely in habitus and consequent habit. What gave them their evolutionary trend we do not know, but their one distinctive character was a vastly increased bulk, which necessitated their forsaking the strictly terrestrial habitat and becoming partly if not wholly water-borne. This increasing bulk also rendered bipedality impossible, and if they were ever really capable of walking exclusively on the hind limbs, they soon lost that power except, perhaps, when in the water; indeed, in certain of the later types a large part of the weight was borne on the fore limbs, which, contrary to dinosaurian custom, actually exceeded the hinder members in length and bulk. As a further consequence of their increasing stature and amphibious habitat, the neck grew very long so that the small head might range through a considerable arc, both horizontally and vertically, in its search for food.

The exact nature of this food we do not know, but the spoon- or pencil-shaped teeth, somewhat worn at the end, are in the front of the mouth as with the true carnivores, and could neither have been used for the rending of flesh nor for the mastication of plant food. The inference is that the dietary was vegetal—possibly some floating or readily dislodged aquatic plant which grew in great abundance, like the water hyacinth of the Nile. This must have been drawn into the stomach in great inert masses, where a powerful muscular device like a gizzard, together with swallowed stones such as have been actually found between the ribs of certain specimens, aided in their digestion.

These creatures waded, as their heavily ballasted limbs imply, or swam where depth required it, but show no distinctively natatory adaptation. They were apparently unarmored, and weaponless, unless the terminal 10 feet of the tail, which was sometimes slender like a whiplash, might be interpreted as a weapon. The earliest forms were moderate in size, some 40 feet perhaps, but the later types were gigantic, the longest authentic measurement being 87 feet, while the living weight exceeded 35 tons. Their bulk, but probably not their length, has been exceeded by the modern whales, but this is because of the slender neck and tail of the dinosaur as compared with the large head borne directly on a neckless trunk and the powerful propelling tail of the cetacean.

Some of the more notable Sauropoda were: *Brontosaurus,* (Fig. 3) 65 feet long and heavily built, from the Comanchian of Colorado to South Dakota; *Diplodocus,* a contemporary, 87 feet in length and much slenderer in build, from Wyoming and Colorado; and *Brachiosaurus,* some 80 feet in length, the most ponderous of all, with huge neck and fore limbs, a giraffe-like wader found in rocks of equivalent age in Wyoming and at Tendaguru, East Africa.

Sauropoda were relatively short-lived, existing through part of the Triassic and the entire Jurassic, becoming apparently utterly extinct early in Comanchian time. What caused their extinction we do not know, probably a complex of causes of which the most important may have been a temporary restriction of their habitat. In such relatively huge forms we have come to see evidences of racial senility, with which, as with old age in general, the hold upon life is precarious and a relatively small cause may have far-reaching and disastrous effects.

Ornithischia.—These dinosaurs have been called predentate, from the fact that the front of their mouth bore in the lower jaw a tooth-

less bone, the predentary, while except in one known instance the front of the upper jaw, the premaxillary, was toothless as well. But in the rear of both jaws were grinding teeth deeply implanted in open grooves and arising in succession from the depth of the groove outward to replace the teeth consumed by wear. Although in the earlier forms the number of teeth was not great, in the terminal member of one phylum, *Trachodon* (see Fig. 4), there were so many vertical rows of successional teeth that their total number equaled a half thousand for each half of each jaw, 2,000 more or less all told! The forward part of the mouth varied in form to suit the owner's habits: in *Trachodon* it was broadened like the beak of a duck; in others, such as *Triceratops,* it was more like that of a parrot or turtle; in all cases the bones must have been encased in horn or a leathery skin and served very well for the prehension of the plant food which the highly efficient dental battery reduced to a proper condition for digestion. This dental mechanism and the bird-like type of pelvis, although varying in detail, were the principal structures which these dinosaurs had in common; in other ways they varied enormously.

FIG. 3—Brontosaurus. 65 feet.

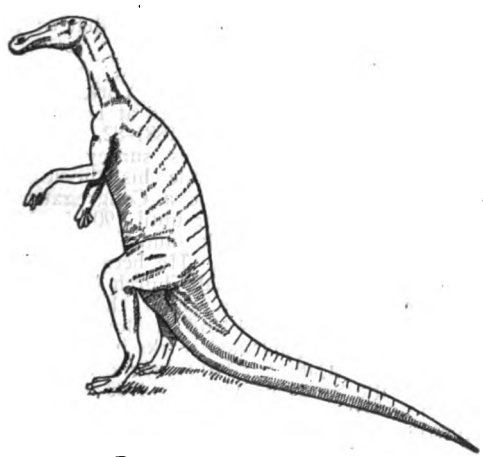


FIG. 4—Trachodon. 23 feet.

Ornithopoda.— These, the bird-footed dinosaurs, were the unarmored bipeds which in their evolution paralleled the carnivores most closely. They had a four-toed foot armed with claws which in the larger forms became almost hoof-like. Their hands varied, but were generally four-toed and never possessed grasping claws. The fore limbs were much smaller than the hind, but never so absurdly so as in the later carnivores, and apparently could always be used to support the forward part of the body and for slow locomotion while feeding, although swifter movement was effected by the hind limbs, with the tail for a counterpoise as in the Theropoda.

The earlier types, such as *Camptosaurus* of the Jurassic and Comanchian, were small to medium in size, ranging from 7 to 17 feet. *Iguanodon* of Belgium and England was more ponderous, reaching 34 feet in length, and bore on the hand a spike-like thumb, the only weapon thus far recorded in the group. The later Cretaceous types show evidence, in their webbed feet and compressed swimming tail, of having been aquatic in habits. They are, perhaps, more completely known than any other dinosaurs, for not only are the bones and teeth preserved, but mummified carcasses, presenting with wonderful fidelity the skin, some muscles, and other details of structure usually lost in a fossil. The Ornithopoda were conservative except in their head, which, while generally simple, sometimes bore a helmet-like crest of curious form. Of such were *Stephanosaurus* and *Corythosaurus* from Alberta, Canada. *Trachodon,* although possessing the most complex dentition, was plain of contour. The last named measured 23 feet in length, and was the terminal member of the race.

Stegosauria.— These were the armored dinosaurs, whose body was covered with an increasingly heavy cuirass and whose tail in some instances possessed an investiture like a battle mace. The later forms, *Ankylosaurus,* must have been well-nigh immune to assault, and they mimicked curiously the armored glyptodons — warm-blooded mammals allied to the armadillos of to-day. The glyptodons had to meet the attack of the sabre-tooth tigers, while *Ankylosaurus* was pitted against the huge *Tyrannosaurus,* but in each case passive resistance was apparently sufficient.

An earlier type, Jurassic to Comanchian, was *Stegosaurus,* the form which gives its name to the group. (See Fig. 5.) It represented an aberrant side line which died without further issue at the time of sauropod extinction, and like the latter group showed evidences of racial old age. *Stegosaurus* was a quadruped, short of fore limb, long of hind, with a highly arched back, powerful tail, and small head containing a deficient dentition and absurdly diminutive brain. But the most striking peculiarity was its armament, which consisted of a double row of armor plates standing on edge, small on the neck, increasingly large until the base of the tail was reached, and then once more diminishing. The end of the tail was armed with two or more

pairs of long spikes which, together with the armor plates, were encased with horn. Stegosaurs are found in Europe and the western United States.

FIG. 5— Stegosaurus. 21 feet.

Ceratopsia.— These were the horned dinosaurs, so far as our knowledge goes an exclusively American group, and although derived doubtless from the armored forms, from what particular type is unknown. They appear suddenly in the West, in rocks of Upper Cretaceous age, and none are transitional but they show at once all of the distinctive features of the group. Chief among these characteristics is a huge head in contrast to the relatively small skull of other dinosaurs. The head bore upon the face a number of horns, one, two, or three, while the rear of the skull was prolonged backward to form an expanded bony crest which served to protect the neck and also to provide leverage for the otherwise unwieldy head and horns. In the earlier types, such as *Monoclonius,* the crest was incomplete, as it had two large apertures through it, one on either side of the middle line. In the later forms such as *Triceratops* (Fig. 6), the crest was a complete sheet of bone, although in one rare genus, *Torosaurus,* it was still perforate. In the earlier forms, the horn borne on the end of the nose was the larger, those on the forehead not always being in evidence, but in later genera the nasal horn was reduced and the frontal ones were dominant.

The Ceratopsia, like the Stegosauria, were quadrupedal, the weight of armor and armament rendering the ancestral bipedal gait no longer possible, and as certain of the latter resembled the later mammalian glyptodons, so the former were rhinocerine in general aspect and were doubtless like the rhinoceros in stupid savagery, for broken horns and jaws and punctured crests give abundant evidence of their combativeness.

Among the dinosaurs there seems to have been a constantly maintained balance throughout

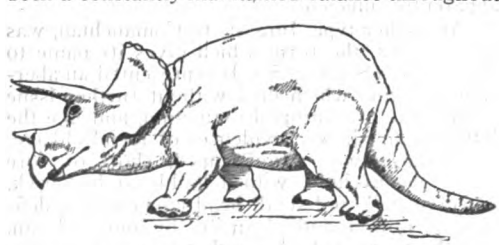


FIG. 6—Triceratops. 22 feet.

their evolutionary career, for as the carnivores grew and increased in prowess, the herbivores were forced to meet the menace of their aggression in several ways, either by increased productiveness, or by speed or bulk, or by a partial forsaking of the terrestrial habitat. Or they developed a defensive armor or aggressive weapons, for one and all lacked brain power; this placed a high premium on brutality, and never perhaps before nor since has the animal world felt to so great an extent the burden of armament.

Extinction.— The cause of dinosaurian extinction is by no means clear. One student has argued internecine warfare; another, destructive slaughter of the young, possibly while yet in the egg, by small blood-thirsty mammals; yet another, climatic change, either diminution of heat, for reptiles are very sensitive to temperature changes, or decrease of moisture, with a consequent change in the character of vegetative life. The close of the age of reptiles was marked by great uplifting or diastrophic movements over portions of the earth's surface — the so-called Laramide Revolution. As a consequence the old low-lying dinosaurian habitat was largely restricted, and this, together with other of the necessary chain of sequent events which follow so great a crustal movement, put a period to their existence and cleared the way for the evolution of a potentially higher, though long subject race, the mammals.

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DINOTHERIUM (Gr. *δεινός*, terrible; *θηρίον*, beast), a genus of elephantine mammals occurring as fossils in the Tertiary rocks of Europe and India, characterized by having the lower incisors developed into dome-curving tusks and by having all the molar teeth in use at once. They probably had a proboscis like that of the elephants. See ELEPHANT.

DINSMORE, Charles Allen, American clergyman and author: b. New York, 4 Aug. 1860. In 1884 he was graduated at Dartmouth College, having previously, 1881–82, been engaged on the United States survey of the Mississippi River. He made his theological studies at Yale and became a Congregational minister in 1888. Therafter until 1901 he held pastorates at Whitneyville and Willimantic, Conn., and Boston, Mass. He became pastor of the First Congregational Church of Waterbury in 1905; was lecturer at the Divinity School of Yale in 1904 and at Bowdoin four years later. His published works include 'The Teachings of Dante' (1901; Japanese trans.); 'Aids to the Study of Dante' (1903; Japanese trans.); 'Atonement in Literature and Life' (1906); and 'New Light on Old Truth' (1912).

DINSMORE, Hugh Anderson, American lawyer: b. Benton County, Ark., 24 Dec. 1850. He was clerk of the Circuit Court 1873–74, when he was admitted to the bar, and began practice in Fayetteville; was prosecuting attorney of the fourth judicial district of Arkansas in 1878–84; a Democratic presidential elector in 1884; minister-resident and consul-general in the kingdom of Korea in 1887–90; and a member of Congress in 1893–1905.

DINWIDDIE, Edwin Courtland, American advocate of Prohibition: b. Springfield, Ohio, 29 Sept. 1867. He received his education at Wittenberg College, Springfield, Ohio, and at Grove City College, Pa. In 1894 he entered the Evangelical Lutheran ministry, was secretary of the permanent committee on temperance of the general synod of the Lutheran Evangelical

Church in 1899–1903, and chairman since 1903. He was legislative superintendent of the Ohio Anti-Saloon League in 1893–96, and State superintendent of the Pennsylvania Anti-Saloon League in 1897–99. In 1899–1907 he was first national legislative superintendent of the American Anti-Saloon League, and again since 1911. He has been a prominent worker in the International Order of Good Templars. He led the attack which led to the abolishment of the army canteen, and was instrumental in continuing prohibition in Oklahoma, also led the prohibition forces in the campaign to prohibit shipments of intoxicating liquors in inter-state commerce. He is author of several pamphlets on prohibition and allied topics.

DINWIDDIE, Robert, British colonial official: b. Scotland about 1690; d. Clifton, England, 1 Aug. 1770. He was lieutenant-governor of Virginia 1752–58; and during his official career recommended the annexation of the Ohio valley and the erection of forts to secure the western frontier against the French. He was one of the most earnest supporters of the French and Indian War, which began about 1753 and lasted 10 years.

DINWIDDIE, William, American journalist and author: b. Charlottesville, Va., 23 Aug. 1867. When only 14 years of age, he was assistant electrician of the National Museum at Washington. He became inspector of customs at Corpus Christi, Tex., in 1883; was connected with the Bureau of American Ethnology from 1886 to 1895, at which time he went into journalism, serving as correspondent and illustrator for the New York *Herald*. He became photographer for the Baltimore and Ohio Railroad in 1897. During the campaign in Cuba and Porto Rico he served as war correspondent. During the Boer War he was correspondent in South Africa for *Harper's Weekly*, and in the Russo-Japanese War he was correspondent for the New York *World*, *Harper's Weekly* and *Leslie's Weekly*. He was associate editor of the New York *World* 1905–06 and is now a broker. He has published 'Puerto Rico and Its Possibilities' (1899); 'The War in the Philippines'; 'The War in South Africa.'

DINWIDDIE COURT-HOUSE and WHITE OAK ROAD, Battle of. General Grant, besieging Petersburg, issued orders 24 March 1865 for a movement on the 29th to destroy the railroads leading into the city from the south to force Lee to come out of his entrenchments and fight on open ground, or so far attenuate his line that a successful assault could be made. The result was the battle of Five Forks (q.v.), the fall of Petersburg and Richmond, the surrender at Appomattox, 9 April and the close of the Civil War. The movement to the left was led by Warren's fifth corps and Sheridan's cavalry, and the first encounter was near the Boydton road, where Warren's leading division (Griffin's) defeated two brigades sent out from Lee's right, driving them back to White Oak road. On the 30th the second and fifth corps closed in on the White Oak road on Lee's right, and Wilcox's Confederate division, coming out of the entrenchments, attacked Warren and was driven back. Warren's advance division was now within 600 yards of the road, and, on the 31st, Lee ordered another attack. Hunton's and Wise's brigades attacked in front, and McGavan's and Gracie's on the left flank. Ayres' and Crawford's divisions were driven back in disorder upon Griffin's division, which checked the Confederate advance. General Miles, with two brigades of the second corps, struck Wise's brigade on the left flank, drove it back with severe loss in killed and wounded, and the entire Confederate attacking party retreated, and Warren, resuming the offensive, pushed his advance across the White Oak road. It cost the second and fifth Union corps, on the 31st, 1,311 killed and wounded, and 556 missing.

Meanwhile Sheridan had reached Dinwiddie Court-House, 12 miles southwest of Petersburg, and on the 30th Devin's division and Davies' brigade were pushed 10 miles in advance in the direction of Five Forks, where they encountered the Confederate cavalry under Gen. Fitzhugh Lee. At night Gens. W. H. F. Lee and Rosser joined Fitzhugh Lee and General Pickett, with five brigades of infantry, marched down the White Oak road to Five Forks, and assumed command of all the troops operating against Sheridan. Munford's cavalry division engaged Devin in front and Pickett moved with infantry and the other two divisions of cavalry to gain Sheridan's left, crossed Chamberlain's Creek, struck Davies' brigade in flank and drove it back on Devin, interposed between Devin and Crook, and with the assistance of Munford drove both Davies and Devin northeastwardly across the country. Fitzhugh Lee moved up and formed his cavalry on Pickett's flanks. In following Devin and Davies, Pickett had exposed the rear of his column and it was attacked by the brigades of Gibbs and Gregg, which attack forced Pickett to face about. He drove back the two brigades and advanced upon Dinwiddie Court-House. Sheridan had called up Custer with his two brigades, some artillery had come up, and a barricade was thrown up about three-fourths of a mile northwest of the courthouse, behind which Gibbs and Gregg rallied, and Smith's brigade, slowly driven back by the Confederate cavalry, formed on the left. It was now near sunset, and as Pickett advanced, artillery opened upon him, and when within short range the cavalry from behind the barricades poured such a shower of bullets upon him that he was quickly repulsed, and the battle of Dinwiddie Court-House was over. Sheridan says his loss was about 450. The Union forces engaged at Dinwiddie Court-House and White Oak road numbered about 42,000; the Confederates about 20,000. The Union loss, 29–31 March, was 2,198 killed and wounded, and 583 missing. The Confederate loss is unknown. Consult 'Official Records' (Vol. XLVI); Humphreys, 'The Virginia Campaign of 1864–65'; Walker, 'History of the Second Army Corps'; Powell, 'History of the Fifth Army Corps'; Grant, Personal Memoirs' (Vol. 11); Sheridan, 'Personal Memoirs' (Vol. II); 'Battles and Leaders of the Civil War' (Vol. IV).

E. A. Carman.

DIOCESE, the territory and population over which a bishop exercises jurisdiction. The word dicœcesis was originally a term of civil administration, when toward the end of the 3d century the Roman Empire was divided into 12 dicœceses governed by the emperor's lieutenants, each dicœcesis comprising several of the

divisions called provinces. When the word came into ecclesiastical use it signified rather one of the grand divisions, patriarchates or primatial jurisdictions, instead of the territory presided over by one of the bishops subject to a patriarch or primate or an archbishop. The word began to be used in the meaning it now has in the latter part of the 13th century; but even later it was used in the sense of our present word parish.

DIOCLETIAN, dī'ō-klē'shăn **(Gaius Aurelius Valerius Diocletianus,** surnamed **Jovius),** Roman emperor: b. Dioclea, Dalmatia, 245 A.D.; d. Salona, Dalmatia, 313. He was of humble origin but attained distinction in the army and held important military commands under the emperors Probus and Aurelian. He accompanied Carus to the Persian War and after the death of Numerianus he was chosen emperor by the army at Chalcedon, 17 Sept. 284, and slew with his own hands Arrius Aper, the prefect of the prætorians. He thus fulfilled the prediction of a Gallic priestess that he would mount a throne as soon as he had slain a wild boar (*aper*). He was generally loved for the goodness of his disposition. But troubles from within disturbed the Roman Empire and compelled Diocletian to share the burden of government with colleagues. He appointed Maximianus Augustus in 286, who defeated the Bagaudae insurgents in Gaul and the Germans on the Rhine. Meanwhile Diocletian was successful against the Persians in the East and afterward penetrated to the sources of the Danube, in Germany. In view of further disturbances and dangers in the empire, he proclaimed Constantius Chlorus and Galerius Cæsars in 293. Thus the empire was divided into four parts, with each of the four rulers at a separate capital — Nicomedia, Mediolanum (Milan), Augusta Trevirorum (Trier), Sirmium. At the age of 60, exhausted with labor, Diocletian resigned the imperial dignity at Nicomedia, 1 May 305, and retired to Salona, where he found happiness in the cultivation of his garden, and where he died eight years afterward. In the latter part of his reign he was induced to sanction a persecution of the Christians, whom he had long protected. In defense of this it may be urged that he hoped to strengthen the empire by a revival of the old religion, and that the church as an independent state over whose inner life at least he possessed no influence, appeared to be a standing menace to the imperial authority. In his reign the senate lost practically all its power, republican institutions vanished and were replaced by an absolute monarchy closely akin to despotism. He wore the royal diadem, assumed the title of lord and introduced a system of etiquette and ceremony, borrowed from the East, in order to surround the monarch and monarchy with a mysterious sanctity. On the other hand he gave great attention to improving the administration of the empire, reformed the coinage, remitted various burdensome taxes, encouraged trade and repressed corruption. He adorned and beautified the city with numerous buildings, notably the baths, portions of which are extant. A famous edict of his and one that has an especial interest in modern days is the 'De pretiis rerum venalium,' which, promulgated in 301 A.D., fixed a maximum price for provisions and other articles of commerce, and a maximum rate of wages. The articles mentioned in the edict which, aside from its illustration of price-fixing legislation, is chiefly interesting as giving their relative values at the time, include cereals, wine, oil, meat, fresh and salt fish, vegetables, honey, fruits, skins, leather, furs, foot-gear, timber, carpets, articles of dress and even pernæ mendapicæ (Westphalian hams), and the wages range from that of the ordinary laborer to the fee of the professional advocate. The unit of money was the denarius, not the silver, but a copper coin introduced by Diocletian, and the value of which may be gauged from the fact that in the edict it is set down as the equivalent of one oyster, or approximately two-fifths of a cent of our currency. The edict was a well-intended but abortive attempt to meet the distress caused by several bad harvests and commercial speculation. It was mainly in the interests of the soldiery. The punishment for exceeding the fixed prices was death or deportation. The actual effect was disastrous, in that it brought about a disturbance of the food supply in nonproductive countries, many traders were ruined, and the edict gradually fell into abeyance. Incomplete copies of it have been discovered at various times in various places, the first (in Greek and Latin) in 1709, at Stratonicea in Caria, by W. Sherard, then British consul at Smyrna, containing the preamble and the tables down to number 403. This partial copy was completed by W. Bankers in 1817. It was elaborately edited by Waddington, with new fragments and commentary (1864), and by Mommsen in the third volume of 'Corpus Inscriptionum Latinarum,' where all the fragments are described and their localities indicated. Portions of the Greek copy and the Latin preamble were found in Platæa in 1888–89 during the exploration of the American School of Classical Archæology. In 1890 several hundred lines of the Greek version of the decree were discovered at Megalopolis, including a list of pigments with their prices. For the edict 'de pretiis, etc.,' in addition to those cited above, consult Lépaulle, 'L'Édit de Maximum' (1886); 'Papers of the American School of Classical Studies,' Vol. V (1892); and Abbott, 'The Common People of Ancient Rome' (New York 1911). For life and administration of Diocletian, consult Preuss, T., 'Kaiser Diocletian und seine Zeit' (Leipzig 1869); Mason, 'The Persecution of Diocletian' (1876); Hunzinger, A. W., 'Die Diocletianische Staats-Reform' (1899); Allard, P., 'La persecution de Dioclétien' (1890); Bernhardt, T., 'Geschichte Roms von Valerian bis zu Diocletians Tod' (1867).

DIODATI, dē-ō-dä'tē, **Giovanni,** Italian Protestant clergyman: b. Lucca about 1576; d. Geneva, 3 Oct. 1649. He was for some time professor, first of Hebrew, then of theology, in Geneva, and in 1618–19 represented the Genevan clergy at the Synod of Dort, and aided in drawing up the Belgic confession of faith. He was unsuccessful in his attempts to spread the Reformed doctrines in Venice and other Italian cities. He is most celebrated for a translation of the Bible into Italian, which is superior to his translation of it into French, and is still in general use among Italian Protestants. His biography by Eugène de Bude appeared at Geneva in 1869.

DIODON, dī'ō-dŏn, a genus of teleostean fish, family *Gymnodontes,* order *Plectognathi,* deriving their name from the fact that the ivory-clad terminations of the jaws show no suture, and the fish thus appear to possess but two teeth. The body, as in other members of the family, can be inflated with air till the creature floats on the surface of the water under side uppermost; it is likewise covered with ossifications in the skin, each with a pair of lateral roots and a stiff, movable, erectile spine. The rotundity of these fish when distended has earned for them the name of globe-fish, or prickly globe-fish, in addition to the designations porcupine-fish and sea-hedgehog, suggested by the numerous spines. The four species of *Diodon* are found in all the seas between the tropics, and range to the Cape of Good Hope. The largest species (*D. hystrix*) attains the length of two feet six inches. The food of *Diodon* consists of crustaceans and sea-weeds, for the trituration of which its jaws are admirably adapted. This genus has by some naturalists been made the type of a family *Diodontidæ.*

DIODORUS (surnamed SICULUS), Greek historian: b. Agyrium, Sicily; fl. second half of 1st century. In order to render his history as complete and exact as possible, he traveled through a great part of Europe and Asia. It is very much to be regretted that the greater part of this history, which the author called the 'Historical Library,' in the composition of which he combined the ornaments of rhetoric with the detail of facts, after the example of Theopompus and Ephorus, and on which he had bestowed the labor of 30 years, has not reached our times. It consisted of 40 books, and comprised the history of almost all nations. It is written in the style of annals and the events are narrated in a confused and discordant manner; it is uncritcal; the writer's lack of military training disqualified him from writing authoritatively on the wars; but the work is valuable as containing a great mass of materials collected from a number of writers whose works have perished. Only the books 1 to 5, containing a history of Egypt, and 11 to 20, which begin with the second Persian War and end with the war against Antigonus, and a number of fragments, are now extant.

DIŒCIOUS, dī-ē'shŭs, in *botany,* a term applied to unisexual plants, such as the willow and the hemp, in which the late staminate and pistillate flowers are on separate individuals. *In zoology,* a term applied to those animals in which the sexes are distinct; that is, those in which the ovum is produced by one individual (female) and the spermatozoid by another (male). It is opposed to monœcious.

DIOGENES, dī-ŏj'e-nēz, the most famous of the Cynic philosophers: b. about 412 B.C., in Sinope, city of Pontus in Asia; d. Corinth 323 B.C. Having been banished from his native place with his father Icesias, a banker, who had been accused of coining false money, he went to Athens and requested Antisthenes to admit him among his disciples. That philosopher in vain attempted to repel the importunate supplicant, even by blows, but finally granted his request. Diogenes devoted himself, with the greatest diligence, to the lessons of his master, whose doctrines he extended still further. At the same time he applied, in its fullest extent, his principle of divesting himself of all superfluities. He taught that a wise man, in order to be happy, must endeavor to preserve himself independent of fortune, of men and of himself; in order to do this, he must despise riches, power, honor, arts and sciences, and all the enjoyments of life. He endeavored to exhibit, in his own person, a model of Cynic virtue. For this purpose he subjected himself to the severest trials and disregarded all the forms of polite society. He often struggled to overcome his appetite or satisfied it with the coarsest food; practised the most rigid temperance, even at feasts, in the midst of the greatest abundance, and did not even consider it beneath his dignity to ask alms. By day he walked through the streets of Athens barefoot, without any coat, with a long beard, a stick in his hand and a wallet on his shoulders; by night he slept in a tub, though this last has been doubted. He defied the inclemency of the weather and bore the scoffs and insults of the people with the greatest equanimity. Seeing a boy draw water with his hand, he threw away his wooden goblet as an unnecessary utensil. He never spared the follies of men, but openly and loudly inveighed against vice and corruption, attacking them with satire and irony. The people, and even the higher classes, heard him with pleasure, and tried their wit upon him. When he made them feel his superiority, they often had recourse to abuse, by which, however, he was little moved. On a voyage to the island of Ægina he fell into the hands of pirates, who sold him as a slave to the Corinthian Xeniades in Crete. The latter emancipated him and entrusted him with the education of his children. In summer he lived at Corinth and in winter at Athens. It was at the former place that Alexander found him on the roadside basking in the sun, and astonished at the indifference with which the ragged beggar regarded him, entered into conversation with him, saying, "I am Alexander the Great," to which the philosopher answered, "And I am Diogenes the Cynic." Alexander finally gave him permission to ask for a boon. "I ask nothing," answered the philosopher, "but that thou wouldst get out of my sunshine." Surprised at this proof of content, the king is said to have exclaimed: "Were I not Alexander, I would be Diogenes." At another time he was carrying a lantern through the streets of Athens in the daytime: on being asked what he was looking for, he answered, "I am seeking an honest man." Thinking he had found in the Spartans the greatest capacity for becoming such men as he wished, he said, "Men I have found nowhere; but children, at least, I have seen at Lacedæmon." We are told that Socrates once remarked to him, "I see your vanity through the holes of your coat"; but history will not admit of the truth of this anecdote. No doubt many of the anecdotes told of this singular man are fiction. He died 323 B.C., at a great age, and, according to tradition, on the same day with Alexander the Great. When he felt death approaching he seated himself on the road leading to Olympia, where he died with philosophical calmness, in the presence of a great number of people, who were collected around him. Consult Hermann, 'Zur Geschichte und Kritik des Diogenes von Sinope' (Heil-

bronn 1860); Windelband-Bonhöffer, 'Geschichte der antiken Philosophie' (3d ed., Munich 1912); Zeller, 'Philosophie der Griechen' (1889).

DIOGENES OF APOLLONIA, Greek philosopher: b. Apollonia, Crete, fl. in the 5th century B.C. Very little is known of his life. His philosophical speculations were developed in his work 'On Nature,' still extant in the 6th century, but of which we have at present only fragments, preserved in the works of Aristotle, Diogenes Laertius and Simplicius. His great object was to find the first principle of the world, out of which all things were evolved. Like his master Anaximenes, he came to the conclusion that this great first principle was air, "the origin of all things" which he believed was endowed with consciousness.

DIOGENES LAERTIUS, Greek philosopher: b. Laerte, Cilicia, toward the close of the 2d century A.D. His chief work is 'Lives, Doctrines and Apothegms of those who have distinguished themselves in Philosophy.' The book is full of absurd and improbable anecdotes, and characterized by much confusion and careless mistakes, yet as containing a mine of information regarding the private life of the Greeks, and many fragments of works now lost, it is of considerable value. It was long the foundation of most modern histories of philosophy, and has preserved the names and doctrines of numerous writers, of whom but for it little would have been known. A translation by Yonge appears in Bohn's Classical Library.

DIOGNETUS, Epistle to, a defense of the beliefs and the religious and social usages of the Christians, written in the 1st century by one who appears to have been himself a disciple of the Apostles, but of whose name and history nothing is known. He refutes the false and malicious accusations brought against his brethren — as that in their assemblies they were wont to practice abominable immoralities, that they were atheists, enemies of all government, etc. He writes with the simplicity and candor of one who has nothing to conceal or to explain away; who rather pities the ignorance of the persecutors than reproaches them for their cruelties and injustices. He is intensely practical in his teaching, laying stress on godly living rather than on correct dogmatic belief. The last two chapters of his work are plainly additions from another hand and are of later date. The Strassburg MS., the sole authority for the text, was destroyed by fire in 1870. "This old writer has gradually emerged, by virtue of an inborn lustre, at once the obscurest and most brilliant of his contemporaries, and has cast a glory on the early Church while remaining himself unknown." Consult Lightfoot (text and translation), 'The Apostolic Fathers' (London 1893); and Crowe, A. C., for English translation in 'The Ante-Nicene Fathers' (Vol. I).

DIOMEDE ISLANDS, a group of three small islands in Bering Strait, and midway between Siberia and Alaska. They were discovered by Bering in the earlier part of the 18th century. One of the islands, Krusenstern, belongs to the United States; the other two, Romanzof and Fairway, to Russia.

DIOMEDEA, a genus of birds, including the various species of albatross (q.v.).

DIOMEDES, king of Argos. He was one of the heroes at the siege of Troy, the son of Tydeus. His daring courage rendered him one of the most distinguished heroes and, according to the testimony of Nestor, superior to all his contemporaries. Protected by Pallas, he not only encountered the most valiant of the enemies, many of whom he killed, but even ventured to attack the immortals. He was equally distinguished in council. He boldly opposed the proposal of Agamemnon to leave the plains of Troy without having gained the object of the expedition, and prevailed; he even adhered to his opinion after Achilles had rejected the proffered reconciliation. By carrying off the horses of Rhœsus from the enemies' tents he fulfilled one of the conditions on which alone Troy could be conquered. With Ulysses he removed Philoctetes who had the arrows of Hercules from Lemnos, which was another condition of the fall of Troy. Finally, he was one of the heroes who were concealed in the wooden horse by whom the capture of Troy was at length accomplished. On his return to Argos, he found that his wife had proved unfaithful, and thereupon sailed away to Italy; several cities of that country claim him as their founder.

DIOMEDES, Villa of. See POMPEII.

DION CASSIUS, Greek historian: b. Nicæa, Bithynia, about 155 A.D.; d. there after 230 A.D. He went to Rome about 180; was appointed successively to many high offices; was twice consul; and wrote, in Greek, the 'History of Rome,' from the arrival of Æneas in Italy to 229 A.D. The portions of Dion's work now extant extend to five volumes.

DION CHRYSOSTOM. See CHRYSOSTOM, DION.

DION OF SYRACUSE, in Greek history, a connection by marriage of the elder and the younger Dionysius, tyrants of Syracuse, over whom he long exercised great influence. He attempted to reform the younger Dionysius, but his enemies succeeded in effecting his banishment (B.C. 366). He twice returned and made himself ruler of the city, but on the first occasion was, after a time, compelled to withdraw; in his second period of rule he became unpopular, and in 353 B.C. was assassinated.

DIONÆA MUSCIPULA ("Venus' flytrap"), a plant of the sundew family (*Droseraceæ*), found in sandy bogs near the coast of North Carolina. Audubon reported specimens of enormous size as growing also in Florida. It is a common plant in hothouses. It exhibits in a remarkable degree the irritability common to some plants. There are three hairs upon each division of the leaf, which are so sensitive that an insect alighting upon one of them causes the two sides of the leaf suddenly to come together with considerable force, the strong bristles of the marginal fringe crossing each other like the teeth of a steel-trap, so as to retain the intruder, whose struggles to escape only increase the pressure of the leaf-trap. The insect is retained until its soft parts are digested and absorbed by the plants, after which the leaf opens and the hard parts drop out. This operation requires about 14 days, but if the insect exciting the leaf is not caught, the leaf opens again after an hour or two. The leaf does not retain its

vigor for any length of time, gradually becoming inert and drying up. Consult Darwin, 'Insectivorous Plants.'

DIONE, in Greek mythology, the mother of Aphrodite (by the Romans identified with Venus).

DIONNE, dē-ôn', **Narcisse Eutrope**, French-Canadian librarian: b. Saint Denis, P. Q., 18 May 1848. He was educated at the Grand Seminary and Laval University, Quebec, began the practice of medicine in 1874, but abandoned it in the following year for a literary and journalistic career. From 1880 to 1884 he was editor-in-chief of *Le Courrier du Canada* and again from 1887 to 1892. He has been secretary of the Associated Press of the Province of Quebec since 1882 and librarian of the legislature of Quebec since 1893. He has written 'Le tombeau de Champlain' (1880); 'Etats Unis, Manitoba et Nord-Ouest' (1882); 'La Nouvelle France de Cartier à Champlain' (1891); 'Vie de Champlain' (1891); 'Mgr. de Forbin-Janson' (1895); 'Hennepin' (1897); 'John and Sebastian Cabot' (1898); 'L'Abbé Richard, curé de Detroit' (1902); 'The Siege of Quebec and the Battle of the Plains of Abraham' (1903); 'Quebec Under Two Flags,' with A. Doughty (1903); 'Inventaire chronologique des livres, journeaux, et revues, publiés en langue française dans la Province de Quebec de 1764 a 1905' (1905); 'Le parler populaire des Canadiens-français' (1908).

DIONYSIA, dī-ō-nish'ī-a, festivals in honor of Dionysus, or Bacchus, which, originating in Egypt, were introduced into Greece by Melampus, 1415 B.C. They were four in number, the Rural or lesser Dionysia, which was the most ancient, the Lenæa, the Anthesteria and the Dionysia proper, all of which were celebrated annually, with much extravagant merriment, though they were not disgraced by the excesses of the Roman Bacchanalia.

DIONYSIUS, Saint, elected Pope in the year 259. He is supposed to have been a native of Greece, but the exact date of his birth is not known. He died 26 Dec. 269, having reigned as pontiff 10 years. Prior to his election as Pope he was held in high repute by the theologians of his day, as history states that Dionysius of Alexandria sent him a most important letter on baptism; and later he was the chief theologian in a synod (262) where the principal question had reference to the Trinity. His able commentaries convinced many who had held views different from those taught by the Church. He labored much to reorganize the Church after the severe persecutions which it had undergone. His feast day in the calendar is 26 December.

DIONYSIUS, Saint, "of ALEXANDRIA": b. Alexandria in the last years of the 2d century; d. there 265 A.D. His family were noble, wealthy and pagans. Early in his life his philosophical studies turned his attention to Christian writings, and they so influenced his mind, especially the epistles of Saint Paul, that he left the pagan schools and became a pupil of Origen. About the year 232 he was ordained a priest, and given charge of the Alexandrian school of theology. In 248 he was consecrated bishop. Shortly after he became bishop of Alexandria the persecution of Decius began, and Dionysius was among the first arrested, and sentenced to be tortured and beheaded. He was rescued by a band of peasants, and for more than a year remained concealed in the Libyan Desert. In 257, during the persecution under Valerian, he was again exiled from Alexandria. His day in the calendar is 17 November. The writings of Dionysius were numerous, but many have been destroyed. His works were chiefly controversial, or attacks on the heresies of his day. Consult Butler, 'Lives of Saints'; the English translation, 'Ante-Nicene Fathers'; Förster 'De Doctrina et Sententiis Dionysii Magni' (Berlin 1865); Harnack, 'Geschichte der altchristliche Litteratur' (Vol. I, Leipzig 1893), and the biographies of Dittrich (Freiburg 1867), and Paul Morize (Paris 1881). Consult also 'Letters and Other Remains,' edited by Feltoc (New York 1904).

DIONYSIUS THE AREOPAGITE, converted to Christianity by Saint Paul (Acts xvii, 34), during the apostle's visit to Athens. Dionysius is called the Areopagite because he was a member of the high court of Athens, the *Areopagus*, which held its sessions on Mars Hill. It was generally believed by the early historians that this Dionysius was ordained a priest, was made bishop of Athens and ended his life by martyrdom. Another tradition had it that he was sent into Gaul by Clement of Rome, and died a martyr on Montmartre. This opinion arose from confusion between Denis the Areopagite and Denis, the patron of France, who founded the church in Paris in the 3d century. The New Testament tells us only that he "did believe" and adhered to Saint Paul. He has been wrongfully credited with being the author of certain ancient writings on subjects chiefly mystical which, though attributed to that member of the court of Areopagus who was converted to Christianity by the preaching of the Apostle Paul, Acts xvii, 34, must be referred to some unknown writer of the 4th or the 5th century: hence the author is now usually styled Pseudo-Dionysius, or Dionysius Pseudo-Areopagite. The titles of the works attributed to the Areopagite are 'The Heavenly Hierarchy'; 'The Ecclesiastical Hierarchy'; 'Divine Names'; 'Mystical Divinity.' Ten letters are attributed to him, purporting to be addressed to Saint John the Evangelist, Titus, Polycarp and others, their contemporaries. These writings came first into notice in 533 at Constantinople when certain Monophysite heretics presented them in confirmation of their doctrines; but they were repudiated by the orthodox as manifestly spurious. Nevertheless before long they came into high favor both in the East and the West and throughout the Middle Ages were received by the most eminent schoolmen as indispensable monuments of the teaching and belief of the early Church. Mgr. Darboy says: "There is scarcely a passage in the writings of Pseudo-Dionysius that has not been quoted by Thomas Aquinas." These writings were studied by the Platonists and others and exerted a tremendous influence on the Humanists. Dante and Milton were familiar with them as were others of lesser note. Erasmus and Valla appear to have been the first to regard them as falsely attributed to this Dionysius and later

authorities agree in their opinion that the works were written near the end of the 5th century. Consult article «Dionysius» in Smith and Wace, 'Dictionary of Christian Biography' (London 1877–87); Koch, Hugo, 'Pseudo-Dionysius Areopagita in seinen Beziehungen zum Neuplatonismus und Mysterienwesen (Mainz 1900); Parker, J., 'The Works of Dionysius the Areopagite' (London 1887); Vaughan, 'Hours with the Mystics' (ib. 1860).

DIONYSIUS THE ELDER, Syracusan tyrant: b. 431; d. 367 B.C. He first attracted general notice during the war against Carthage. When Agrigentum fell, he openly accused the generals concerned, brought about their dismissal and had another staff appointed of which he himself was a member. In a short time he removed his associates and took full command himself. He soon supplanted his colleagues. He contrived to make himself master of the citadel of Syracuse, together with all the arms and provisions contained in it, and finally to declare himself tyrant, at the age of 25 years. After having finished a short war against the Carthaginians he made preparations for a great war against Carthage. He attacked the Carthaginians at once by land and water, and gained a complete victory, which was soon followed by an advantageous peace. In 368 he commenced a new war against the Carthaginians, intending to drive them entirely out of Sicily. He did not, however, succeed in this attempt, and was obliged to conclude a disadvantageous peace. He holds the unenviable place in ancient history as the representative tyrant. He lived in continual dread of assassination, of which the sword of Damocles has become the symbol. He had the state prison so constructed that even the solitary murmurings of its inmates could be heard by him, and it was hence called the Ear of Dionysius. During his régime the prosperity of the city grew apace and it became the first city of the Greeks. Plato, Aristippus and Philoxenus were among the notable personages who visited his court. In 367 Dionysius won first prize at Athens for the tragedy, 'Ransom of Hector.' Consult Freeman, 'History of Sicily' (Oxford 1894); Grote, 'History of Greece' (London 1853), and Holm, 'Geschichte Siciliens' (Leipzig 1874). See SICILY; SYRACUSE.

DIONYSIUS THE YOUNGER, Syracusan tyrant: b. 395. He succeeded his father, Dionysius the Elder, in 367 B.C. Dion, his kinsman, directed his attention to the doctrines of Plato, representing to him that this great philosopher alone was able to teach him the art of government, and the means of rendering his subjects happy. In consequence of this advice Dionysius invited Plato to his court. The latter succeeded in tempting him into the path of virtue and knowledge, and in giving a new character to his whole court. An opposite party, however, under the historian Philistus, awakened the king's suspicions against Dion, and caused his banishment. Dion subsequently made himself master of Syracuse in 356, to which Dionysius did not return until after the murder of Dion. During his exile he retired to Locri in Italy, the birthplace of his mother, Doris. Here he ruled despotically until 346. The rule of Dionysius now became so oppressive that the Syracusans sought the aid of Corinth to oust him and Timoleon in 343 appeared with a fleet before Syracuse, and expelled the tyrant. Dionysius was carried to Corinth, where he is said to have gained a scanty living by giving lessons in grammar.

DIONYSIUS EXIGUUS, an eminent scholar of the 6th century. He it was who introduced the now existing method of calculating the Christian era. He was a monk and, according to his close friend Cassiodorus, was of Scythian origin (*natione Scytha*). His surname Exiguus (little) was perhaps self-assumed by him out of humility, for lowly mindedness is one of the virtues enumerated by Cassiodorus in his eulogy of his friend; but the surname may have had reference to his stature. His reputation was high as a theologian and as one intimately conversant with the Scriptures and with the ordinances of the Church. He is author of a collection of ecclesiastical constitutions and canons which is still extant, including the first 50 canons of the Apostles; the canons of 10 councils; and 38 decretals of the popes, from 384 to 498. This collection had great authority in the West, and in modified form was solemnly promulgated by Charlemagne in 802. Many writings of ancient Greek authors have been saved for us in the translations made of them into Latin by Dionysius. Dionysius died before 555. Several of his works are to be found in Migne, 'Patrologiæ Latinæ Cursus Completus' (Vol. LXVII). (See CHRONOLOGY; CANON LAW). Consult Tardif, 'Histoire des sources du droit canonique' (Paris 1887).

DIONYSIUS OF HALICARNASSUS, Greek critic, historian and rhetorician: b. about 50 B.C.; d. 7 B.C. He came to Rome about 29 B.C., and lived there on terms of intimacy with many distinguished contemporaries till his death. His most valuable work is his 'Archæologia,' written in Greek, a history of Rome down to 264 B.C. Of the original 20 books, we possess only the first nine in a complete form. It is a mine of information on the constitution, history, law, religion and social life of Rome, and is highly regarded by scholars despite the author's lack of historical discrimination and his inability to distinguish clearly between fable and fact. He was a greater rhetorician and critic than historian, and his extant works on oratory, on the criticism in detail of the great Greek orators, on the characteristics of poets and historians from the time of Homer to Euripides, and upon Thucydides and Dinarchus possess great interest and value. A Latin edition of the Archæologia appeared in 1480, but the first edition of the Greek original was that by Stephens (Paris 1546). Fragments of the lost books from a Milan manuscript were published by Angelo Mai (Milan 1816), but are of doubtful authenticity. His complete works on oratory, etc., including 'Censura Veterum Scriptorum'; 'Ars Rhetorica'; 'De Compositione Verborum'; 'De Imitatione'; 'On the Style of Demosthenes' and 'On the Character of Thucydides,' were edited by Usener and Rademacher (Leipzig 1899). There is a good edition of the 'Archæologia' by Jacoby (Leipzig 1891) and of the 'De Compositione Verborum' by W. Rhys Roberts (Cambridge 1901); the

latter also edited 'The Three Literary Letters' of Dionysius (ib. 1901), containing valuable biographical and bibliographical material. Consult Boksch, "De Fontibus Dionysii Halicarnensis," in 'Leipziger Studien' (Vol. XVII, 1895) and Sandys, 'A History of Classical Scholarship' (Vol. I, 2d ed., Cambridge 1906).

DIONYSIUS, Ear of. See EAR OF DIONYSIUS.

DIONYSUS, dī-ō-nī'sŭs, the original Greek name of the god of wine, the name Bacchus, by which he was also called by both the Greeks and the Romans, being at first a mere epithet or surname. See BACCHUS.

DIOPHANTINE ANALYSIS, that branch of algebra which treats of the method of solving certain kinds of indeterminate problems relating principally to square and cube numbers, and rational right-angled triangles. The following are examples: (1) To separate a given square number into two parts, each of which shall be a square number; (2) to find three square numbers which are in arithmetical progression; (3) to find a right-angled triangle whose sides shall be commensurable with each other.

DIOPHANTUS OF ALEXANDRIA, Greek mathematician; the "Father of Algebra." He flourished, according to some authorities, about the middle of the 3d century, according to others about the end of the 6th. He left 13 books of 'Arithmetical Questions,' of which only six are extant; and a work on 'Polygon Numbers.' See DIOPHANTINE ANALYSIS.

DIOPSIDE, a variety of the mineral pyroxene occurring in monoclinic prisms. It is a silicate of calcium and magnesium, having the formula, $CaMg(SiO_3)_2$. Iron is occasionally present in considerable amount, replacing the magnesium, and it then graduates toward hedenbergite. It has a hardness of about 6, and a specific gravity of about 3.3. It is usually pale green to nearly colorless and when transparent yields gems of considerable beauty. The finest gems come from Dekalb, N. Y., where it occurs in transparent crystals varying from colorless to a deep, rich green. The Mussa Alp, in the Ala Valley, Piedmont, is another celebrated locality from which it is also called Alalite and Mussalite.

DIOPTASE, a rare, beautiful and highly prized mineral, occurring in prismatic crystals of rich emerald-green color and vitreous lustre. Its inferior hardness, 5, greater specific gravity, about 3.3, the terminal rhombohedrons on its crystals, and its reactions for copper, easily distinguish this so-called "emerald-copper" from the true emerald. It is found sparingly near Clifton and near Riverside in Arizona, also in the French Kongo, Chile and Hungary, but the finest specimens are from the Kirghese Steppes, Asiatic Russia.

DIOPTRICS (from Gr. *dia,* through, root *op,* see), the science which treats of the refraction of the rays of light, when the rays pass through different refracting mediums — for instance, from the air, through the lenses of a telescope. Dioptrics, consequently, is a branch of optics. It demonstrates the different directions in which the rays move, according as they are broken on plane or curved surfaces. The principles deduced from these observations determine the nature of the various lenses, explain the manner in which the light is refracted in the human eye, teach the manner of making telescopes, microscopes, etc. The ancients were not acquainted with this science. Natural science in modern times has been greatly indebted to it. By its aid the human eye has been enabled to reach objects previously unknown. Kepler, Snellius of Leyden, Descartes, Newton, etc., not only extended this science, but founded a great part of their discoveries on it. In modern times, science has been enriched by the invention of the achromatic telescope. See LENS; OPTIC LIGHT; REFRACTION; TELESCOPE.

DIORAMA, a method of reproducing landscape scenery, invented or perfected by M. Daguerre, and first exhibited by him in 1823. The particular advantage which this method possesses is that it causes the light to play over the picture with an intensity graduated at will. The illusion is heightened by the cloth transparencies, through which light is poured from behind the picture. The principle of the diorama was successfully applied in producing some of the prettiest scenic effects of the modern stage.

DIORITE, a medium- to coarse-grained dark gray or greenish-colored rock consisting essentially of hornblende, biotite mica, and plagioclase felspar that have a granitoid, or completely crystalline, texture. According to variations in composition, there are augite-diorites which grade into gabbros and quartz-diorites which grade into granites. The hornblende and augite-diorites are dark-colored; the quartz-diorites, light-colored. As augite changes readily to hornblende, many so-called diorites may represent altered diabases and gabbros; by further metamorphism the hornblende changes to chlorite. Diorites under shearing stresses may be changed into hornblende and chlorite schists. Andesites and dacites are rocks of the diorite family, but having a porphyritic texture. As compared with the syenites, diorites contain less potash and soda but more lime and magnesia, hence the principal felspar is soda-lime. It has more lime, magnesia and iron than granite and less silica and potash, these constituting the chief differences. It is often used for building. True diorites are rare in the United States, though quartz-mica diorites and augite-diorites are not uncommon, and grano-diorites — the intermediate stages between diorite and granite — occur in great masses in the Sierra Nevada, in California. True diorites occur in various places abroad. One from Wales contains SiO_2 61.75; Al_2O_3 18.88; Fe_2O_3 0.52; FeO 3.52; Cal. 3.54; MgO 1.90; Na_2O 3.67; K_2O 1.24; and has a specific gravity of 2.79.

DIOSCOREACEÆ, a natural order of monocotyledonous plants, with alternate reticulate, veined leaves, tuberous root-stocks and twining stems. The flowers are small and unisexual. There are nine genera, with about 200 species, chiefly inhabiting tropical America and South Africa. The typical genus is *Dioscorea,* which includes the yam of commerce (*D. sativa*). The best-known species in eastern America is the wild yam-root (*D. villosa*), which is found in moist thickets from Rhode

Island north, south to Florida and west to Texas. It ascends to 4,000 feet in the Virginia Mountains. The flowers are of a greenish-yellow bloom in June and July, and the fruit, which adheres to the vine until late in the winter, is ripe in September. *Tamus* (*Testudinaria*) *elephantines*, a South African species, sometimes called elephant's foot, and Hottentot's bread, has a large fleshy rhizome, with a rough cracked bark, which is used as food by the Hottentots in times of scarcity.

DIOSCORIDES, Peda'nius, Greek physician: b. Anazarbus (Cæsarea Augusta), in Cilicia, in the 1st century A.D. He was a physician in the Roman armies which he accompanied in their various campaigns in several countries, and collected a great store of information on plants in general and on medicinal plants in particular. He was author of a celebrated work on materia medica, in five books. It is particularly valuable in regard to botany, as most of the medicines which the author mentions are taken from the vegetable kingdom. Two other works attributed to him by Photius are by a later Dioscorides of Alexandria — the 'Alexipharmaca,' which was united with the 'Materia Medica,' forming the three last books of it, and treating of the poisons in the three kingdoms of nature, and their antidotes; and the 'Euporista,' which treats of remedies that are easily procured. For 15 centuries his position was pre-eminent in botany and medicine, and he is still highly regarded by the Moors and Turks. The best edition of Dioscorides is that of Sprengel (2 vols., Leipzig 1829–30). It contains a Latin translation and a commentary. The work has appeared in most European tongues and also in Arabic.

DIOSCURI, di-ŏs-kū'rī, the classical name for Castor and Pollux, twin brothers, and tutelary deities of wrestlers, horsemen and navigators. Their transplantation to the sky as one of the 12 constellations of the zodiac (the Twins) is a celebrated allegory of mythology. They are sometimes styled Tyndaridæ, because Tyndarus was the nominal father of both.

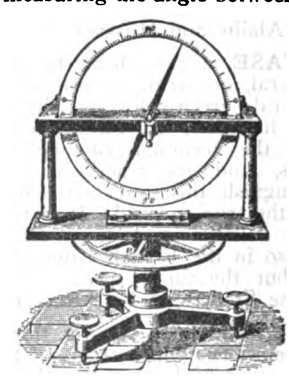
DIOSCURUS, or **DIOSCORUS,** patriarch of Alexandria, immediate successor (444) of Saint Cyril, was a supporter of the heresiarch Eutyches (q.v.). Pope Leo and Flavianus, patriarch of Constantinople, having condemned the teachings of Eutyches, Dioscurus procured from the Emperor Theodosius II the convocation of a council of bishops at Ephesus in 449. To this council Pope Leo sent three legates as his representatives. Dioscurus was present, surrounded by a host of his satellites, and with their aid prevented the legates from presiding in the council and even from reading to the bishops the letters addressed to the assembly by Leo. Flavianus was so roughly handled by the rabble that he died shortly after in consequence of the injuries he received. The council thereafter got the title of Latrocinium (Brigandage) from the Latins, and of Σύνοδος ληστρική from the Greeks (robbers' synod); but Theodosius upheld its decisions, and Dioscurus procured the appointment of one of his partisans, Anatolius, to succeed Flavianus in the see of Constantinople. After the death of Theodosius another council assembled at Chalcedon in 451, which annulled the decrees of the Latrocinium of Ephesus and decreed the deposition of Eutyches from his offices as presbyter and archimandrite.

DIOSMA, a genus of plants belonging to the rue family (*Rutaceæ*). They are small shrubs with white or red flowers; leaves alternate or opposite, simple. They are remarkable for their overpowering and penetrating odor, arising from the presence of a yellowish volatile oil. They are the buchu plants of the Cape of Good Hope. The plant has been employed in chronic affections of the bladder and urinary organs in general, and has also been administered in cholera.

DIOSPYROS, a genus of plants belonging to the ebony family (*Ebenaceæ*). There are about 190 species, most abundant in Asia. They consist of trees and shrubs with white or pale yellow flowers. *D. lotus* is the Indian date-plum, and is supposed by some to be the lotus of the ancients. The trees of several of the species furnish ebony wood. The fruit of *D. kaki*, the Japanese persimmon, is a well-known fruit. *D. virginiana*, the most common American representative of the genus, is the persimmon (q.v.)

DIP, *in geology*, the maximum angle of inclination of any stratified rock or of a vein or of a fault plane to the horizontal of a given point. In the same way the cleavage planes of any metamorphic rock are said to dip and a thin intrusion of igneous rock, a dike, has a dip. Also the contact plane of an igneous and a sedimentary rock may have a well-defined dip. The direction of the dip is the line of highest inclination and is expressed by compass bearing; thus a bed may dip 63 degrees north, 35 degrees east. The line of intersection of the dipping bed or plane with the horizon is known as the *strike*, and is at right angles to the direction of dip. The angle of dip is determined by an instrument known as a clinometer (q.v.). Initial dip is the name given to the slight inclination away from the land that sedimentary beds have as a whole when laid down in the sea. Such initial dips are often of importance in determining flexures when the sediments are subsequently subjected to mountain-building pressures. See FAULT; FOLD; GEOLOGY; MOUNTAIN.

DIP CIRCLE, also called **INCLINATION COMPASS** and **INCLINOMETER,** an instrument for measuring the angle between the plane



Dip Circle

of the horizon at any place and the position assumed by a magnetic needle so mounted as to be capable of turning freely in a vertical plane.

When the vertical plane coincides with the magnetic meridian of the place, the resulting angle is called the Dip. An unmagnetized needle if suspended at a point which coincides with its centre of gravity and placed horizontally, will, of course, remain always in a horizontal position, but if the same needle be magnetized it will not only assume the magnetic north and south direction, but it will also take up an inclined position with reference to the horizon, the north end of the needle pointing downward at places north of the earth's equator and the south end being depressed in southern latitudes. At either of the magnetic poles of the earth the needle will point directly downward, that is the dip will be equal to 90 degrees. On the equator the dip is approximately 0 degrees, while in intermediate latitudes it has values intermediate between these. At Greenwich at the present time the dip is 66 degrees 54 minutes, but at all places the value is subject to somewhat irregular daily, seasonal, and yearly change. Thus at Greenwich the value diminished for a long time at the rate of about two minutes a year, thus changing the dip by a full degree at intervals of about 30 years.

DIPHTHERIA (Gr. *diphtheria,* a skin, piece of leather, extended in meaning to comprise membrane), a contagious and (in its severe forms) malignant disease, caused by a specific bacillus, and generally characterized by the formation of a fibrinous false membrane in the throat. Although previously observed, it was first clearly described in 1826 by M. Bretonneau of Tours under the name of "diphtherite," as a form of very fatal sore throat occurring chiefly in children. It is now known that most cases of membranous croup are identical with diphtheria. The membranous inflammations of the throat occurring sometimes in scarlet fever and other infectious fevers may or may not be true diphtheria, a bacteriological examination being usually necessary to determine this point.

The period of incubation is usually from two to seven days. The disease begins by malaise, feeling of chilliness, loss of appetite, headache and more or less fever; soon the throat feels hot and painful and the neck is stiff and tender. If seen early, the throat is red and swollen, but a false membrane of yellowish or grayish color quickly appears in spreading patches, usually first on the tonsils, whence it often spreads to the pillars of the fauces, uvula and back of the throat, and may even extend down the œsophagus or gullet; extension of the membrane into the nasal cavities is a grave symptom. There is usually enlargement of the glands at the angle of the jaw, and albumen in the urine generally occurs at some stage of the disease. Diphtheritic membrane may be formed on any mucous surface, or even on a wound; if it extends into the larynx it gives rise to cough and difficulty in breathing. The throat affection is often accompanied by a low and very dangerous form of fever, with quick, feeble pulse and great and rapid loss of the patient's strength, which is still further reduced by the inability to take food; in other cases, the disease is fatal by paralysis of the heart or by suffocation, due to invasion of the larynx. Invasion of the larynx may necessitate intubation or tracheotomy. After the acute disease is over, the recovery may be delayed by paralytic symptoms of various kinds; or simply by extreme debility with exhaustion and loss of appetite. In the early stages of convalescence there is danger of sudden heart failure upon exertion.

Diphtheria is communicable. It may occur as a complication of scarlet fever, measles and other communicable diseases. All gradations in the intensity of the disease from mild sore throat to septic and gangrenous forms occur. Damp and temperate climates seem to favor its development. Insanitary conditions favor its occurrence, but the disease may appear under the most favorable hygienic surroundings. An important mode of its spread is by school children, either infected in a mild form or coming from households where the disease exists. One attack affords little or no protection against recurrence. In the treatment of the disease the patient should be isolated and all clothing and other articles which have been in contact with the sick, as well as the discharge, should be disinfected. Local applications to the diseased parts and means to maintain the strength of the patient were the most valuable therapeutic measures before the introduction of the antitoxin treatment.

True diphtheria is now known to be caused by a specific bacillus called *Bacillus diphtheriæ,* or the Klebs-Löffler bacillus. This bacillus was first recognized by Klebs in 1883 by microscopical examination of diphtheritic membranes, but it was first successfully cultivated by Löffler in 1884. Its causal relation to the disease was not thoroughly established till the investigations of Roux and Yersin in 1888, who demonstrated the existence of a peculiar and intensely poisonous substance known as the diphtheria toxin. It is now generally admitted that the Klebs-Löffler bacillus is the cause of true diphtheria. The diphtheria bacillus is a slender rod characterized especially by irregularities in shape and staining with aniline dyes. It grows best at about the temperature of the human body, and all growth ceases below 20° C. It can be cultivated artificially on various media, but best on a mixture of blood serum and beef-broth rendered solid by heating. In a moist condition the bacilli are killed in a few minutes by a temperature of 60° C. They survive for months in a dried condition. Exposure to the direct rays of the sun kills the bacilli, in a short time. Guinea-pigs, when inoculated beneath the skin with a small quantity of a pure culture of the virulent diphtheria bacillus, die within two to five days with characteristic changes in the body. Skilled bacteriologists can recognize the presence of diphtheria bacilli in the throat by microscopical examination and the appearances in the cultures within 24 hours or less, but their complete identification may require the inoculation of a guinea-pig. Both in human beings and in animals the bacilli grow only or mainly locally in the false membrane, the severe constitutional symptoms being due to the absorption of a powerful poison secreted by the bacilli.

The ways in which diphtheria bacilli may be conveyed from sick to healthy persons are almost countless. In ordinary breathing the expired breath contains no germs, but in speaking and especially in coughing, a fine spray is emitted which may contain the bacilli and thus convey the disease. All sorts of articles, such as handkerchiefs, toys, drinking utensils, furniture, clothing, bed-linen and the like, may be-

come contaminated with the bacilli and be the means of spreading the disease. The specific germs have been found in the hair, on the shoes, and elsewhere on the persons of those brought into frequent and close proximity to the patient. Direct contact with the patient, as in kissing, may communicate the disease. It is especially through direct or mediate contact with infected individuals that the disease is spread. Hence, preventive measures, consisting in isolation of the patient till the bacilli have disappeared from the throat, and in thorough disinfection, are of the first importance in checking the spread of diphtheria. Insanitary conditions, formerly thought to be the direct cause of diphtheria, are now regarded only as accessory causes in affording opportunities for the prolonged survival of the specific germs or in weakening the powers of resistance of the individual.

The discovery of the diphtheria bacillus has led to the introduction of a new and most successful method of treatment of the disease, known as serum-therapy or the antitoxin treatment. The establishment of the principles and the introduction of this treatment are due especially to Behring of Germany and Roux in Paris. The underlying principle of the treatment is based on the fact that, if a susceptible animal is inoculated first with small and then with increasing doses of the toxin produced by the bacillus, the blood of the animal is found to contain a substance called antitoxin, which has the power of neutralizing or rendering harmless the toxin. In order to obtain large quantities of the healing serum a horse is generally selected for the process of immunization. By proper methods very powerful antitoxins can be obtained. The antitoxin is used not only to cure the disease, but also to render persons insusceptible for a time to the disease. This latter procedure of preventive inoculation has been found especially useful in preventing extensive outbreaks in children's hospitals and asylums after the introduction of one or more cases of diphtheria. Dr. William H. Welch, of the Johns Hopkins University, in 1895, in an analysis of over 7,000 cases of diphtheria treated by antitoxin found that the fatality was reduced by this treatment by over 50 per cent of the previous death-rates; he concluded that the antitoxin serum is a specific curative agent for diphtheria, surpassing in its efficacy all other known methods of treatment for this disease. Since his report, this conclusion has been confirmed and even more favorable results have been obtained.

Some idea of the great benefits which have been derived from the discoveries outlined above may be had by comparing the death rate before and after the serum therapy became the practice. For the five years immediately preceding the discovery and use of antitoxin in the city of Berlin the death rate for diphtheria in every 10,000 inhabitants was 10.2 per cent, and for the next five years it fell to 3.7 per cent; in Paris, 6.5 per cent before antitoxin, and 1.3 per cent afterward; in New York 14.5 per cent before, and 6.3 per cent after antitoxin. So safe is the use of antitoxin, it is now advised that every child exposed should receive an immunizing dose, as that confers protection.

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DIPHTHONG (Gr. "having a double sound"), two vowel sounds, following one another so closely as to form but one syllable, as in *out*, where the sound is really composed of *a* and *u*. Many double vowels in English are not real diphthongs, there being only one sound heard, whereas some single vowels have a diphthongal sound. The only real English diphthongs are *i* as in *high; i* as in *aye; oi* in *boil; ow* in *how;* and *ew* in *mew.*

The spelling of the English language has little or no relation to pronunciation in this matter. In many syllables written with two vowels, only one sound is heard, as in *bread.* The single vowel letters, again, often have a diphthongal sound; thus the long *i*, as in *high*, is really composed of the sound of *a*, as heard in *father*, and that of *e* in *me;* and *tune* is pronounced as if written *teun.* Such words as *bread, field*, which are now monophthongs, are really diphthongs, and are still so pronounced in many parts of England.

DIPLEGIA. See PARALYSIS.

DIPLOBLASTICA. See EMBRYOLOGY.

DIPLOCOCCUS. See BACTERIA.

DIPLODOCUS, dĭ-plŏd'ō-kŭs, a saurian-footed, herbivorous dinosaur found in the Jurassic deposits of Colorado. The length of skull of this species was about 21 inches, of brain about 3 inches and of body 50 feet. The cast of a reconstructed specimen in the Carnegie Museum, Pittsburgh, measures 84 feet in length and is 12 feet 9 inches in height. The animal is supposed to have been a hippopotamus-like wader, and to have lived on vegetation in the water. It would weigh about 20 tons, and require about 500 pounds of vegetable food every day.

DIPLOMA (Gr. *diploō*, "fold" or "double"), originally a document on two tablets of wax (see DIPTYCH), or on writing material which was folded. The Roman emperors granted diplomas to couriers, giving them the use of public servants and horses; hence diploma came to signify a writing or document conferring some power, authority, privilege or honor, usually under seal and signed by a duly authorized official. Diplomas are given to graduates of a university on their taking their degrees; to clergymen who are licensed to officiate; to physicians, civil engineers, etc., authorizing them to practise their professions; and are awarded as a certificate of merit at exhibitions. In European countries all diploma-conferring bodies are under state supervision and control, and a movement is on foot to make similar provision in the United States.

DIPLOMACY. See AMERICAN DIPLOMACY; INTERNATIONAL LAW; UNITED STATES — DIPLOMACY OF THE.

DIPLOMATICS, the science of deciphering ancient MSS., inscriptions, etc., now generally known as PALÆOGRAPHY (q.v.).

DIPLOPIA, dĭ-plō'pĭ-ą, an affection of the sight in which objects are seen double. It arises from derangement of the visual axis and can be remedied by the wearing of suitable glasses.

DIPLOPTERUS, a genus of fossil ganoid fishes, of four species, belonging to the Old Red Sandstone.

DIPLOZOON, a parasitic trematode worm which infests the gills of the bream, and which appears to be formed of two distinct bodies united in the middle, and resembling an × or Saint Andrew's cross, and only double individuals thus attached are capable of becoming sexually mature. The larva, formerly called *Diporpa,* swims about in the water for a time, but ultimately settles in the gills of a fish, where it remains during the rest of its existence. The larvæ then unite in pairs by the attachment of the ventral sucker of one individual to a knob on the back of another.

DIPNOI, one of the primary subdivisions of fishes, characterized by the presence of membrane or covering bones on the skull, the absence of secondary bony jaws (maxillary, premaxillary and dentary bones), and the direct articulation of the lower jaw with the skull. The *Dipnoi* were early predominant in geological times, many and varied forms occurring as fossils in the Middle and Upper Palæozoic strata. Some of these, forming the order *Arthrodira,* are of doubtful relationship, and are classed with the *Dipnoi* only provisionally. The best-known representatives of this group have the anterior region of the body enclosed in continuous bony plates, with a complex articulation between the head and trunk. In the Devonian of Ohio are found giant forms, like *Dinichthys* and *Macropetalichthys,* from 10 to 25 feet long, and with sharp-beaked jaws like a turtle's. Numerous other *Dipnoi,* more closely resembling the still living ones, have been found as fossils in various parts of the world. At the present time the group is decadent, and but three genera and as many species, each found in a restricted area in widely separated regions of the earth, remain. They are, *Protopterus* from Africa, *Lepidosiren* from South America, and *Ceratodus* from Australia. On account of the lung-like structure of the swim-bladder and its function as an organ of respiration, they are known as lung-fishes. Being the earliest vertebrates which are believed to have breathed air, the *Dipnoi* have an exceptional interest, and many zoologists consider them to have been the original stock from which the *Amphibia* and all other terrestrial vertebrates arose. See MUDFISH; STEGOCEPHALIA. Consult Cope, 'Origin of the Fittest' (New York 1886); id., 'Batrachia of North America' (Washington 1899); Dean, 'Fishes, Living and Fossil' (New York 1895); Gadow, 'Amphibia' (London 1901); Lydekker, Cunningham, Boulenger and Thomson, 'Reptiles, Amphibia, and Fishes' (ib. 1912).

DIPPEL, Johann Konrad, German mystic and alchemist: b. Frankenstein, near Darmstadt, 10 Aug. 1673; d. Berleburg, Prussia, 25 April 1734. He became involved in difficulties political and theological, and wrote tracts (1697, 1698) attacking Lutheran theology, which ruined him with all parties, and which provoked replies in the same spirit as that in which the attacks had been made. To avoid persecution he was forced to lead a wandering life. He was imprisoned in a Danish fortress (1719–27) and afterward, through clerical influence, was banished from Sweden. He became a student of alchemical books, and at once threw himself into the search for the philosopher's stone. He is remembered as the refiner of Dippel's Oil (q.v.), from which followed indirectly that of Prussian blue — an accidental discovery, it is true, but one of a class that could hardly have been made but for the constant and multifarious, though not well-directed labors, of such men as Dippel.

DIPPEL'S OIL, the black fetid oil which was formerly produced by the destructive distillation of bones, and was used medicinally. Dippel, in 1711, refined it by washing with lime or potash, and rectifying the oil until it became limpid and aromatic. This rectified oil was the *oleum animale Dippelii* of the older pharmacopœias, which was prescribed in doses of a few drops as an antispasmodic and diaphoretic, and as a hypnotic.

DIPPER, a name given to the seven stars in the constellation of the Great Bear, from their being arranged in the form of a dipper, or ladle.

DIPPER, a water-ouzel. See OUZEL.

DIPPING-NEEDLE, or **INCLINATION COMPASS,** an instrument for measuring the magnetic dip or inclination; that is, the angle which a magnetized needle, free to move in the plane of the magnetic meridian, and about a horizontal axis, makes with the horizontal plane at the place. The dipping-needle is a light magnetized steel bar supported on a horizontal axis which passes, as nearly as possible, through the centre of inertia of the bar. The axis is either a steel knife-edge which rests on agate plates, or a fine wire supported by friction-rollers. A vertical circle surrounds the needle, the axis on which the needle turns being at the centre; the circle is graduated, and the needle moving over the graduations, the inclination to the horizon can be read off by means of it. The vertical circle is mounted on a vertical pillar, which turns round its own axis; and to the pillar there is attached at the foot an arm or pointer, which moves over a horizontal graduated circle. This last is supported on three legs furnished with leveling screws.

To observe with the dipping-needle the vertical circle must be placed in the plane of the magnetic meridian, and then the angle at which the needle is inclined must be read off by means of the graduations on the circle. The plane of the magnetic meridian might, of course, be determined by means of a separate instrument, such as the declination compass. But this is not necessary, the vertical pillar and horizontal circle described above furnishing all that is required. A complete observation is made in the following way. The instrument having been properly leveled, the vertical circle is turned round on the pillar till the needle points vertically downward. When this is the case we know that the needle must be moving in the vertical plane at right angles to the plane of the magnetic meridian, because it is only in this plane that there is no horizontal component of force acting on the needle. The vertical circle is now turned round on the pillar through 90 degrees, which is done exactly by means of the horizontal circle at the foot. The needle is thus free to move in the plane of the magnetic meridian, and the inclination is read off.

Corrections for defects in the instrument must be applied in order to make the determination exact. In the first place, in order to correct for any error in centring of the axis

on which the needle turns, readings are taken at both ends of the needle. Next, because the magnetic axis of the needle may not coincide with the axis of the figure, the needle is turned over on its bearings, and fresh readings are taken. Thirdly, the axis on which the needle turns may not pass exactly through the centre of inertia of the needle. If this were the case the needle would not balance about the axis exactly, one or other end of it being the heavier. To do away with error from this source, after one set of readings have been taken, the needle is lifted from its bearings and remagnetized, the end that was formerly north being now made the south end. A complete new set of readings is taken. The mean of all these gives the true inclination. See DECLINATION NEEDLE; MAGNETISM, TERRESTRIAL.

DIPROTHODONTY. The state of the enlargement in an animal of a pair of cutting teeth, while the neighboring teeth are reduced. This adaptation is frequent and arises independently in many orders of mammals, ancient as well as modern. It is most prominently and familiarly illustrated in the incisors of the rodents, as the rat or the beaver. Sometimes instead of the middle pair, the side pair is so enlarged and it is not always easy to determine their true affinities.

DIPROTODON, dī-prō'tō-dŏn, a huge extinct marsupial of the Pleistocene Period in Australia. Its nearest living relatives are the wombats and kangaroos, which it somewhat resembled in the character of the head, which was three feet long. The animal was by far the largest of the marsupials, almost equaling a small elephant in size and resembling the elephants in its rather long legs and short post-like feet. The structure of the foot-bones is very remarkable; the great toe is short and stout, the others reduced to small slender rudiments. Its dentition showed molars transversely ridged as in the kangaroo, but without the longitudinal connecting ridge. Its remains have been found in great abundance in certain dried-up salt lakes (Lake Callibona, etc.) of the central and south Australian deserts.

DIPSACUS, the typical genus of the *Dipsaceæ*. See TEASEL.

DIPSAS, a genus of tropical opisthoglyph serpents, mostly tree-snakes with greatly elongated bodies and protective coloration, which are usually nocturnal, and feed mainly upon lizards and birds and their eggs, though some species pursue mammals and other birds exclusively. Their posterior poison-fangs (see OPISTHOGLYPHA) are large, but they differ in venomous ability, which is rarely deadly to a large animal. This and several allied genera form the colubrid sub-family Dipsadinæ.

DIPSOMANIA. See ALCOHOLISM.

DIPTERA, an order of two-winged insects, of which the common housefly and bluebottle are familiar examples, and of which some 40,000 species are known; the number yet to be described will bring the total to 350,000. They are characterized by a body with slight coriaceous coverings, a trunk open beneath and containing a sucker composed of two, four or six lancet-shaped elongated scales, two palpi, antennæ almost always composed of three joints, large eyes, an abdomen of four to seven distinct segments, tarsi with five joints and two short clubbed appendages called *halteres* or balancers, which seem to be the rudiments of the posterior pair in four-winged insects and are kept in continual motion. They all undergo a complete metamorphosis. They are found in the earth, the air and the water in all climates and in all localities. The far greater number live exclusively on the sap of flowers. See FLIES.

DIPTERACEÆ, or **DIPTEROCARPEÆ,** an important order of exogenous trees. They are found in India, and especially in the eastern islands of the Indian archipelago. There are about 10 genera and over 100 species known. The trees belonging to this order are handsome and ornamental, and abound in resinous juice. When young, the *Dryobalanops camphora* yields, on incision, a pale yellow liquid, consisting of resin, and a volatile oil having a camphoraceous odor; when old, it furnishes a kind of crystalline camphor. Other species produce fragrant resins used in temples, also varnishes; while some of the commonest produce pitches and valuable timber.

DIPTERUS ("two-winged"), a fossil fish occurring in the Devonian rocks and belonging to the Dipnoi sub-class, family *Dipteridæ*, of which this is the typical genus. Its distinguishing character is the possession of double dorsal and caudal fins. An interesting fact connected with it is that it approaches nearer to the lung-fishes than do any of the present existing ganoids.

DIPTYCH, dĭp'tĭk, a tablet consisting of two leaves, light boards, held together by a hinge. In the time of the Roman empire diptychs were much used in correspondence between friends and were given by magistrates inscribed with names and portraits to friends on the assumption of office. Even when three boards or more were used the name diptych (*Sintoxos*, folded double) was generally retained instead of triptych, tesseraptych, etc. Diptychs figure largely in the history of the Church for several centuries, being tokens of intercommunion between the assemblies of the faithful throughout the world. The use of diptychs in the liturgical service was in full vogue in the middle of the 4th century and it must have commenced much earlier. It was continued in the Latin Church to the 12th century and in the Greek Church to the 15th. The Diptychs of the Living had inscribed on them the names of the pope, patriarchs, bishops then living and presiding over the faithful in their respective spheres; also the names of the clergy of the particular churches in which they were kept; names also of benefactors of the churches, of the emperor and the empress, etc. For all these the faithful offered their prayers. The Diptychs of the Dead contained usually the names which had once been written in the Diptychs of the Living. In the diptychs were also inscribed the names of the Virgin Mary, martyrs and other saints. If any name, whether of the living or the dead, was erased from the diptychs it signified that the person was regarded as out of the communion of the Church. The diptychs both of the living and dead were read from the *umbo* or pulpit to the congregation. Church calendars and martyrologies seem to have had their origin in the diptychs. In

the Roman Missal, the marks of the diptychs are very evident. At the prayer, "Te igitur," the names of the reigning pope and the bishop of the diocese are mentioned. In other prayers of the Mass the diptychs are followed. Consult Kraus, 'Real-Encyclopädie'; Benedict XIV, 'De Missa.'

DIPUS. See JERBOAS.

DIQUE, dēk, Canal del, Colombia, an "artificial arm" of the Magdalena River in the department of Bolívar. It is navigable by steamers, and is a means of communication between Cartagena and the interior of the republic. Its total length is about 74½ miles, and in its course it passes through several swamps and receives the waters of various conduits, reaching the coast south of Cartagena.

DIRÆ, dī'rē, or EUMENIDES. See FURIES.

DIRCE, dĕr'sē, in Greek legend, the second wife of Lycus, king of Thebes, who from jealousy imprisoned Antiope, whom Lycus had divorced in order to marry herself; but Jupiter set Antiope at liberty, when she soon gave birth to two sons, Amphion and Zethus. These latter grew up in ignorance of their parentage. They were commanded by Dirce to bind Antiope to the horns of a wild bull that she might be dragged to death; but having learned the secret of their relation to Antiope, they compelled Dirce to accept the fate she had designed for their mother. The gods, pitying her misfortunes, changed her into a spring, which bears her name and flows near Thebes.

DIRCKS, Henry, English civil engineer: b. Liverpool, 26 Aug. 1800; d. Brighton, 17 Sept. 1873. After 1827 he lectured on chemistry and electricity; later becoming distinguished as a railroad and mining engineer. He also made several inventions, including the mechanical device known as "Pepper's Ghost." He published 'Jordan-Type, otherwise called Electrotype' (1852); 'History of the Search for Self Motive Power' (1861); 'The Ghost as Produced in the Spectre Drama' (1863); 'Inventions and Inventors' (1867), etc.

DIRECT AND INDIRECT TAXES, the former are those which in theory the bearer cannot transfer to others, by adding correspondent charges to goods or service; as distinguished from indirect, those on goods for sale, which will be added to their selling price. Direct taxes are laid according to some fixed fact, as of personality, rank, property or earnings, and are consequently assessed according to some list or roll. Indirect taxes are laid according to some changing, temporary, more or less accidental fact, the result of processes and transactions, and are laid and collected according to tariffs. Direct taxes in current understanding include taxes on polls, property, incomes and privileges — that is, fees and licenses for doing business, keeping pets, carriages, etc. But the Supreme Court of the United States, in the income-tax cases, decided that only taxes on polls and property are direct; which is law for this country. The theory at best does not quite conform to facts. Taxes on real estate occupied by the owner, for example, are not transferable; but those on property for rent are so much added rent charge, and as indirect as customs duties. The heavy license fees charged by many municipalities for doing certain classes of business are *pro tanto* an increase of the business expense, and must be met in the charges if the business is to live; often, indeed, they are used openly as "protective," to give industries of one State an advantage over others — this is especially so with insurance companies. On the other hand, income taxes on salaries cannot in practice be transferred, as an employer will not raise salaries on account of his employees' taxes; while those on mercantile incomes are in the same category as those on licenses, and can to some extent be recouped from customers. All State and municipal revenues in the United States are raised from direct taxes in the broader sense; the constitution prohibits them from laying duties on exports or imports, but not on internal manufactures, which, however, are also left entirely to the general government. In American usage, indirect taxes generally refer to customs and internal revenue duties. On the Continent of Europe they include the octroi and other forms of municipal taxes. Historically, indirect taxes preceded direct taxes, because sovereigns found it necessary to disguise the collection of revenue and secure it by methods more or less concealed. Although this motive no longer exists in its cruder aspects, there is no doubt that it is easier to collect revenue through increased prices of commodities than by direct payments to the treasury. Practically all of the Federal revenue is derived from indirect taxes. The Federal income tax is a notable exception. The cost of collecting indirect taxes is as a rule greater than that of direct taxes. Only six times in its history has the Federal government resorted to direct taxation, in the narrower sense above: in 1798, 1813, 1815 and 1816, on real estate and slaves; in August 1861 a levy of $20,000,000 for war expenses was laid on all house lots with dwellings and improvements. The operation of the act was suspended 1 July 1862, when $15,000,000 had been collected; and the act of 2 March 1891 refunded it to the States; and on 3 Oct. 1913 the Underwood Tariff Act imposed on every citizen of the United States, and every person residing in the United States a personal income tax on his entire net income in excess of $3,000. Consult Bullock, 'Origin and Effect of the Direct-Tax Clause' in *Political Science Quarterly,* XV (1909); Bastable, 'Public Finance' (2d ed., 1895); Seligman, 'Essays in Taxation' (1897); Plehn, 'Introduction to Public Finance' (1909). See REVENUE TAX; INCOME TAX; IMPOSTS; TAXATION.

DIRECT AND RETROGRADE, terms which, when used in astronomy, have reference to the real or apparent motion of the planets. When the planet moves forward or appears so to move, from west to east, in accordance with the order of signs in the zodiac, the motion is said to be direct. When the motion appears contrary it is said to be retrograde.

DIRECT LEGISLATION. See REFERENDUM.

DIRECT PRIMARY. See CONVENTION, POLITICAL; PRIMARY, DIRECT ELECTIONS.

DIRECTORS, the persons authorized to manage and direct the affairs and business of a corporation or company. The directors are

sometimes called managers or trustees in accordance with the purpose and nature for which the corporation or company was formed. At the present time, nearly if not all corporations are formed under general laws and it depends on the law under which the corporation is created as to the number of directors and their qualifications. The general qualification is that all directors must be stockholders in the corporation or, if it has no stock, they must be members of the corporation. The directors are generally elected by the stockholders, and some States have passed laws allowing cumulative voting, by which each stockholder may multiply the number of his shares by the number of directors to be elected, and cast all his votes for one director or distribute them in any manner he desires. It has been held that this kind of a law is unconstitutional, if applied to corporations created before the law was passed; as it impairs the obligation of the contract. It may be valid, if applied only to corporations created after the passage of the act. In some cases directors are appointed. The directors must act as a body and not as individuals. A majority of the board of directors is necessary to a legal meeting and if that number is present a majority of those present will be sufficient to perform any act. When there is a quorum present, all acts performed are presumed to be done in the regular course of business. The directors for the purpose of the business of the corporation are held to be the corporation itself; and their powers and duties depend on the laws under which the corporation is formed and the charter and by-laws of the corporation. Notice to the board of directors during a meeting of any matter in which they are required to act is notice to the corporation.

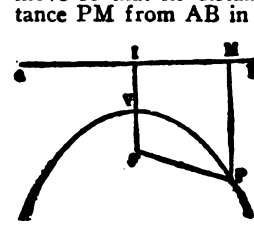
The directors are considered as general agents of the corporation, and they are the only ones that can manage the business of the corporation; although the directors are generally elected by the stockholders they are responsible to the corporation and through the corporation to the stockholders. As the directors derive their power from the charter their acts are of no effect if they are outside of the delegated power; and all acts performed by the directors which are outside of their power must be passed upon by the stockholders.

While directors are sometimes called trustees, they are not held to the same strict accountability as an ordinary and regular trustee; although their position is a fiduciary one. At common law directors are under no personal liability for the debts or obligations of the corporation. They are, however, liable to the stockholders in an action of tort for gross negligence or misfeasance in office resulting in loss to them. The directors may deal with the corporation the same as any other individual; but they cannot use their position for any special benefit to themselves. They may even go so far as to buy up the indebtedness of the corporation and at a sale buy in and acquire the absolute title to the corporate property. The directors may delegate their power to an agent, as a private individual may do, and the agent's power is not impliedly revoked by a change of the members of the board, as the act of appointment is not that of the directors individually but of the board. The directors have a discretionary power and when it is honestly exercised there is no one that can make them account for their acts. A frequent illustration of this power is in relation to suit by or against the corporation, as to whether they shall be brought or defended. If a director's individual interests are in conflict with the interests of the corporation the act must be fair and just to the corporation. Modern statutes have increased the liability of directors of corporations to an extent varying considerably in the different States of the Union. A provision sometimes made is one making directors personally liable for the debts of the corporation if they do not file annually with the Secretary of State a report upon the affairs and business of the corporation. Usually the motive of the director in taking the office is the prosperity of the concern as benefiting him in the position of a stockholder. See CORPORATIONS.

DIRECTORS OF INCORPORATIONS. See CORPORATIONS, LEGAL.

DIRECTORY, in French history, the executive body established by the constitution of the French republic, 28 Oct. 1795. (Fr. *directoire*). This body consisted of five members, called directors (*directeurs*) who were chosen by the Council of Elders from candidates presented by the Council of Five Hundred. Each director was president for three months in rotation, and one was compelled to make room for a new member every year. The unpopularity of the directory's home policy was increased in 1799 by the disastrous results of its war policy, and it was easily overthrown by the *coup d'état* of Napoleon and his brother Lucien, 9 Nov. 1799. (See FRANCE). Consult Barante, 'Histoire du Directoire' (3 vols., Paris 1855); Granier de Cassagnac, 'Histoire du Directoire' (3 vols., ib. 1863); Guyot, 'Le Directoire et la paix de l'Europe' (ib. 1911); Pierre, 'La terreur sous le Directoire' (ib. 1887); Sciout, 'Le Directoire' (4 vols., ib. 1895–97); Sorel, 'L'Europe et la révolution française' (8 vols., ib. 1910).

DIRECTRIX (Lat. *linea directrix* "a directing line"), in mathematics, a line governing the direction of another line. If a point so move that its distance from a given fixed point is to its perpendicular distance from a fixed straight line in a constant ratio, it describes a conic section, of which the fixed straight line is termed the directrix and the fixed point the focus. The constant ratio referred to is termed the eccentricity, and its magnitude determines the nature of the conic. Thus, if in the figure, AB be the directrix and F the focus, if the point P move so that its distance from F is to its distance PM from AB in a constant ratio, then P will trace out a conic section, which will be an ellipse, parabola, or hyperbola, according as the ratio in question is less than, equal to, or greater than unity — that is, FP is less than, equal to, or greater than PM, or FV than VI. A quadric surface has a directrix with analogous relations. The fixed lines on which rests the line whose motion, right or curved, generates a surface, are called directrices or directing lines.



DIRHEM, dĕr'ăm, or **DRAMM**, a modification of the Greek *drachma*, the name under the caliphs for a weight of silver equivalent to about 45 grains, and was also used for precious stones and medicine in Arabia, Persia, Egypt and Turkey. As a coin the value varied, but may be given at 11 cents under the caliphs. In Turkey the name dirhem has been given to the much smaller weight, the French gramme.

DIRIGIBLE. Steerable, drivable; usually applied to lighter than air flying machines which may be propelled and guided.

Form and Size.— If ability to rise in the air depended merely upon a knowledge of the principle that made it possible, dirigible navigation would undoubtedly have been accomplished many centuries ago. Archimedes established the fact that a body upon floating in a fluid displaces an amount of the latter equal in weight to the body itself, and upon this theory was formulated the now well-known law that every body plunged into a fluid is subjected by this fluid to a pressure from below, equivalent to the weight of the fluid displaced by the body. Consequently, if the weight of the latter be less than that of the fluid it displaces, the body will float.

Once in the air, a balloon is, to all intents and purposes, a part of the atmosphere. There is scarcely any sensation of movement, either vertically or horizontally. The earth appears to drop away from beneath and to sweep by horizontally, and regardless of how violently the wind may be blowing, the balloon is always in a dead calm because it is really part of the wind itself and is traveling with it at exactly the same speed. If it were not for the loss of lifting power through the expansion and contraction of the gas, making it necessary to permit its escape in order to avoid rising to inconvenient heights on a very warm day, and the sacrifice of ballast to prevent coming to earth at night the ability of a balloon to stay up would be limited only to the endurance of its crew and the quantity of provisions it was able to transport. Unless a voyage is to be governed in its direction entirely by the wind, the dirigible must possess a means of moving contrary to the latter. The moment this is attempted resistance is encountered, and it is this resistance of the air that is responsible for the chief difficulties in the design of the dirigible. To drive it against the wind it must have power; to support the weight of the power plant necessary, the size of the gas bag must be increased. It is also necessary to select a form that presents as small a surface as possible to the air as the dirigible advances, while preserving the maximum lifting power. Experience has strikingly demonstrated the analogy betwen the marine and aerial practice — not only is the shape of the bow of the vessel of great importance but, likewise, the stern. The profile of the latter may permit of an easy reunion of the molecules of air separated by the former, or it may allow them to come together again suddenly, clashing with one another and producing disturbing eddies just behind the moving body. Marey-Monge laid down the principle that to be successfully propelled through the air, the dirigible must have "the head of a cod and the tail of a mackerel," and nature exemplifies the truth of this in all swiftly moving fishes and birds. The pointed stern prevents the formation of eddies and the creation of a partial vacuum in the wake, which would impose additional thrust on the bow. Zeppelin has disregarded this factor by adhering to the purely cylindrical form with short hemispherical bow and stern, but it is worth note that while other German investigators originally followed this precedent, they have gradually abandoned it, owing to the noticeable retarding effect.

Next in importance to the best form to be given the vessel is the most effective size — something which has a direct bearing upon its lifting power. This depends upon the volume, while the resistance is proportional to the amount of surface presented. Greater lifting power can accordingly be obtained by keeping the diameter down and increasing the length. As the gas is frequently under considerable pressure when the balloon expands under the influence of the sun's heat, a great deal of experiment has been necessary to find the best class of fabric for the making of the envelope. Under the pressure an ordinary fabric would stretch and permit the escape of a large percentage of the gas. It has been found impossible to weave any fabric that will be close enough to hold hydrogen under pressure, so that recourse is had to a combination of cloth and rubber. The cloth is an extremely fine weave of cotton, even closer and lighter than the best of racing yacht duck, and is combined with rubber under high pressures. Three layers of this rubberized fabric are cemented together to form what is known as "balloon cloth," which is about as impenetrable a material as can be made without involving undue weight. The necessity of using rubber in it has introduced a complication, it having been found by experiment that rubber is strongly attacked by the ultra-violet rays of sunlight, which probably accounts for the fact that balloon envelopes are usually found more or less damaged after a high ascension, the influence of these rays being much greater at higher altitudes.

Stability.— Having settled upon the size and shape, there must be an appropriate means of attaching the car to carry the power plant, its accessories and control and the crew. While apparently a simple matter, this involves one of the most important elements of the design — that of stability. A long envelope of comparatively small diameter being necessary for the reasons given, it is essential that this be maintained with its axis horizontal. In calm air, the balloon, or container, is subjected to the action of two forces. One is its weight, applied to the centre of gravity of the system formed by the balloon, its car and all the supports; the other is the thrust of the air, applied at a point known as the centre of thrust and which will differ with different designs, according as the car is suspended nearer or farther away from the balloon. If the latter contained only the gas to inflate it, with no car or weight to carry, the centre of gravity and the centre of thrust would coincide, granting that the weight of the envelope were negligible. As this naturally cannot be the case, these forces are not a continuation of each other. But as they must necessarily be equal if the balloon is neither ascending nor descending, it follows that they will cause the balloon to turn until

they are a continuation of each other. As this would be neither convenient nor compatible with rapid propulsion, it must be avoided by distributing the weight along the car in such a manner that when the balloon is horizontal the forces represented by the pressure above and the weight below must be in the same perpendicular. This is necessary to assume a horizontal position while at rest. But the longitudinal stability of the airship as a whole must be preserved. Its axis must be a tangent to the course it describes, if the latter be curvilinear, or parallel with the direction of the course where the course itself is straight. This is apparently something which should be taken care of by the rudder, any tendency on the part of the airship to diverge from its course being corrected by the pilot. But a boat that needed constant attention to the helm to keep it on its course would be put down as a "cranky" boat, in other words, of faulty design in the hull. A dirigible having the same defect would be difficult to navigate, as the rudder alone would not suffice to correct this tendency in emergencies. Stability of direction is accordingly provided for in the design of the balloon itself, and this is the chief reason for adopting the form of a large-headed and slender-bodied fish. This brings the centre of gravity forward and makes of the long tail an effective lever which overcomes any tendency of the ship to diverge from the course it should follow. However, the envelope of the balloon itself would not suffice for this, so just astern of the latter. "stabilizing surfaces" are placed, consisting of vertical planes fixed to the envelope. These form the keel of the dirigible and are analogous to the keel of the ship.

In addition to being able to preserve its static equilibrium and to possess proper longitudinal stability, the successful airship must also maintain its dynamic equilibrium — the equilibrium of the airship in motion. This may be made clear by referring to the well-known expedients adopted to navigate the ordinary spherical balloon. To rise, its weight is diminished by gradually pouring sand from the bags which are always carried as ballast. To descend, it is necessary to increase the total weight of the balloon and its car, and the only method of accomplishing this is to permit the escape of some of the gas, the specific lightness of which constitutes the lifting power of the balloon. The balloon, or the container itself, being merely a spherical bag, on the upper hemispherical half of which the net supporting the car presses at all points, the question of deformation is not a serious one. Before it assumed proportions where the bag might be in danger of collapsing, the balloon would have had to come to earth through lack of lifting power to sustain it longer. Owing to its far greater size, as well as to the form of the surface which it presents to the air pressure, such a crude method is not applicable to the dirigible. Dynamic equilibrium must take into account not only the dirigible's weight and the sustaining pressure of the air, but also the resistance of the air exerted upon its envelope. This resistance depends upon the dimensions and the shape of that envelope, and in calculations the latter is always assumed to be invariable. Assume, for instance, that to descend the pilot of a dirigible allowed some of the hydrogen gas to escape. As the airship came down, it would have to pass through strata of air of constantly increasing pressure as the earth is approached. The reason for this will be apparent as the lower strata bear the weight of the entire atmosphere above them. The confined gas will no longer be sufficient to distend the envelope, the latter losing its shape and becoming flabby. As the original form is no longer retained, the centre of resistance of the air will likewise have changed together with the centre of thrust, and the initial conditions will no longer obtain. But as the equilibrium of the airship depends upon the maintenance of these conditions, it will be lost if they vary. In the design of a successful dirigible, the proper location of the propulsive effort with relation to the balloon is a very important factor. Theoretically, this should be applied to the axis of the balloon itself, as the latter represents the greater part of the resistance offered to the air. In theory, the balloon offers such a substantial percentage of the total resistance to the air that the area of the car and the rigging were originally considered practically negligible by comparison. Actually, however, this is not the case. Calculations show that the sum of the surface of the suspending rigging, passengers, air pump and other transverse members and exposed surfaces, total an equivalent of a quarter or even a third of the transverse section of the balloon itself. To insure the permanently horizontal position of the ship under the combined action of the motor and the air resistance, a position of the propeller at a point about one-third of the diameter of the balloon below its horizontal axis will be necessary. Without employing a rigid frame like that of the Zeppelin and the Pax, however, such a location of the shaft is a difficult matter for constructional reasons. Consequently, it has become customary to apply the driving effort to the car itself, as no other solution of the problem is apparent. This accounts for the tendency common in the dirigible to "float high forward," and this tilting becomes more pronounced in proportion to the distance the car is hung beneath the balloon. The term "deviation" is employed to describe the tilting effect produced by the reaction of the propeller. Conflicting requirements are met with in attempting to reduce this by bringing the car closer to the balloon as this approximation is limited by the danger of operating the gasoline motor too close to the huge volume of inflammable gas. The best solution of the problem has been found by placing the motor in the car, and driving a shaft so located between the car and the balloon by means of a chain.

The Speed.—Various factors influencing the speed of a dirigible have already been referred to, but it will be apparent that the radius of action is of equally great importance. It is likewise something that has a very direct bearing upon the speed and, in consequence, upon the design as a whole. It is evident that to be of any great value for military or other purposes, the dirigible must possess not only sufficient speed to enable it to travel to any point of the compass under ordinarily prevailing conditions of wind and weather, but it must likewise be able to remain in the air for some time and cover considerable distance under its own power. In fact, one of the chief advantages possessed by the dirigible over the aeroplane at

present is its ability to make long sustained flights, while carrying a comparatively large crew and a great deal of extra weight. As is the case in almost every point in the design of the dirigible, conflicting conditions must be reconciled in order to provide it with a power plant affording sufficient speed with ample radius of action.

Power requirements increase as the cube of the speed, making a tremendous addition necessary to the amount of power to obtain a disproportionately small increase in velocity. In this connection there is a phase of the motor question that has not received the attention it merits up to the present time. The struggle to reduce weight to the attainable minimum has made weight per horse power apparently the paramount consideration — a factor to which other things could be sacrificed. But it is quite as important to make the vessel go as it is to raise it in the air, so that the question of total weight per horse power hour will undoubtedly come in for much more attention in future, particularly since weight per horse power appears to have approached so closely the minimum attainable consistent with a due regard for reliability.

The relative importance of these two factors may be appreciated from the following example:

Assume, for instance, a 100 horse-power motor of a total weight of 1,000 pounds, round figures being chosen merely for the sake of simplicity. The weight per horse power of such an engine would be 10 pounds. This would not be sufficient data, however, from which the design of a dirigible to employ that motor could be worked out. Pounds per horse power usually refers to a bare engine. The weight of cooling water, lubricants, accessories, and last, but far from least, that of the fuel must be added. For example, the motor referred to may be assumed to require one pound of fuel and lubricant per horse power to run it at its normal output. This means that it will consume 100 pounds per hour, or for a run of 10 hours 1,000 pounds, and this weight must be added to that of the motor itself in considering the design from the standpoint of radius of action. This factor depends entirely upon the efficiency of the motor, while its weight per horse power is a question of its construction alone. It requires no abstract calculation to show that it is quite as possible to have the same number of pounds for the weight per horse power if a very light engine that consumes a great deal of fuel is used as it is with a heavy engine that consumes very little. The diminution of the weight per horse-power hour makes possible an increase in the duration of the voyage, which is a very desirable advantage, but as the prime factor is the ability to rise, improvement that involves the addition of weight is closely restricted by the lifting power available, so that radius of action is governed by numerous considerations. Take a dirigible with a gas capacity of 12,000 cubic feet, equipped with two 60 horse-power motors, giving it a speed of 36 miles per hour. The engines will consume 130 pounds of fuel per hour, and the machine, with six passengers, will have sufficient lifting capacity to carry 1,300 pounds of gasoline. This would mean traveling for 10 hours, or 5 hours in each direction. The radius of action of this dirigible would be 180 miles.

Speed is quite as costly in an airship as it is in an Atlantic liner. To double it the motor power must be multiplied by 8 and the machine must carry 8 times as much fuel. The wind is a serious factor that has to be taken into consideration. Radius of action as above considered has been based entirely upon traveling in a dead calm. True, where the prevailing wind blew from a certain quarter for a length of time, its favoring influence in going would be neutralized by its resistance in returning, so that the result would be the same, providing the velocity of the wind were not too great to prevent returning at all against it.

When the speed of the dirigible is greater than that of the prevailing wind the dirigible may travel in any direction; when it is considerably less it can travel only with the wind; when it is equal to the speed of the latter it may travel at an angle with the wind — in other words, tack, as a ship does, utilizing the pressure of the contrary wind to force the ship against it. But as the air does not offer the same hold on the hull of the airship as water does on the sea-going ship, the amount of drift in such a manœuvre would doubtless be excessive and the forward motion practically nil.

The Zeppelin Type.— Outwardly a Zeppelin may be described as a long cylinder with ogival ends and a V-shaped keel running the length of its bottom. From afar the cylinder and pointed ends appear circular in cross section, but they are 16-sided. About one-third of the distance from either end of the great ship a small boat is suspended from the hull so closely that at those places the keel is omitted to make room. These two boats are rigidly connected with the hull and support it when the vessel rests on or is towed along the water. Within them are the crew and petroleum engines, while above them and outward on each side of the hull and fastened to it by outrigging are two pairs of screw propellers, so placed as to exert their united thrust along the line of resistance. In some cases the crew can walk through the V-shaped keel from one boat to another, the passageway being illuminated here and there by transparent covering. Again an observer may climb up through the hull and take observations of the sky from above. Telephones, electric bells and speaking tubes serve to transmit intelligence from one part of the vessel to another.

The frame of the hull is formed of 16 or more longitudinal beams or girders of trellised metal work running from prow to stern and riveted at regular intervals to cross bridges of similar trellised metal work, each cross bridge being a 16-sided wheel with trellised rims strengthened by radial rods running inward to a central flange of sheet aluminum. Thus the body of the vessel is divided into many compartments, each bounded by two wheels and the surrounding longitudinal beams. Each compartment contains a hydrogen balloon or sac, which fairly fills it and exerts a lift against the longitudinal beams and against a netting formed of ramie cords stretched from wheel to wheel, diagonally between beams at their inner corners. Similarly the outward corners of the beams are joined by strong diagonal wires for the purpose of rigidity, and the whole external frame is covered with a heavy fabric which forms the outer skin or wall of the hull. Between this skin and the hydrogen bags are air spaces, as

also between bag and bag. Thus the whole vessel is buoyed up by numerous thin hydrogen sacs, protected by the frame and outer skin from the direct sun, from foul weather and from external shocks. The modern Zeppelin is supported by about 18 separate gas bags, each of which contains within itself a small air balloonet, in which the air pressure is maintained at a given point by means of an automatic air pump and relief valve. If, therefore, the temperature of the hydrogen in the gas bags becomes high enough to expand the gas, the pressure set up by it on the outside of the balloonet forces the air out of the balloonet through the relief valve, and the correct pressure is in that way adjusted without the loss of hydrogen. The converse happens in case the temperature of the hydrogen falls, and its bulk for that reason becomes less. When it becomes necessary to reduce the buoyancy of the machine hydrogen can be pumped from the gas bags and stored in a compressing cylinder, this hydrogen being available for use later when desired to increase the buoyancy again. By the simultaneous manipulation of horizontal rudders and "trimming" devices and the discharge of ballast a Zeppelin can shoot up to a higher level at the rate of 2,000 feet per minute, the engines in this case assisting the lifting power of the gas.

The size of the Zeppelin has changed constantly since 1912, as shown by the following table:

	Cubic metres	Length metres	Diameter metres
Type 1912	19,500	141	14.80
Type 1913	22,000	156	14.80
Type 1914	27,000	158	16.58
Type 1915	30,000	which should give a length of about 160 metres.	

Other Types.— The Lebaudy airship employed by the French is an example of the semi-rigid type of dirigible. In this design a substantial keel extends to the full length of the vessel; and to this keel is attached the machinery, together with the accommodation arrangement for the crew. The keel is securely fixed to the gas bag above it, to which it gives very considerable support. In the German service the Gross airship is another of this type. The envelope of a non-rigid airship keeps its shape only by the pressure of its gas, the car carrying the machinery etc. The German Parseval, French Clement-Bayard and the Astra Torres are all examples of this type.

The Parseval gas bag is provided with an air-balloonet in its forward end and another aft, the amount of air in each of these balloonets being controlled by a pump in the car. When it is desired to alter the trim of the vessel, air is transferred from the container in the forward end to the other one, with the result that the after end of the ship becomes the heavier. A cord attached to the exterior of the balloonets passes through the hydrogen to a valve in the exterior of the gas bag. If the hydrogen expands to such an extent that the combined capacity of these vessels is insufficient to relieve the excessive pressure, their collapse causes a strain on the cord which opens the relief-valve in the gas bag and allows some of the hydrogen to escape.

During the first few months of 1916, the British authorities developed a dirigible of considerable importance. Small of structure, its range is naturally limited, but it is capable of great speed which makes it a particularly desirable instrument. A unique feature of this dirigible is its car, which constitutes an ordinary fusilage of a British army aeroplane complete with its engine tractor air-screw or propeller. Even the landing gear wheels are retained. This is particularly practicable for small structures where it advantageously does away with the heavy car, which together with the elaborate engine mounting and propeller transmissions greatly reduces the load and also reduces head resistance which greatly retards the speed of the vessel. During the year 1916 only one dirigible was constructed in the United States — a small vessel of a type of construction which embodied no departure from European practice. See MILITARY AERONAUTICS.

G. DOUGLAS WARDROP,
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DIRK, a kind of dagger formerly carried sheathed between skin and stocking as a weapon by the Highlanders of Scotland. Dirks are worn by midshipmen and cadets of the British navy. See DAGGER.

DIRK-HARTOG, dĕrk-här'tŏg, **ISLAND,** an island on the west coast of western Australia, at one of the entrances to Shark Bay, which it partly encloses; area, about 250 square miles. It forms a plateau with good pastures and plenty of water. The pearl oyster and edible oysters are here in great abundance.

DIRSCHAU, dēr'show, Prussia, city, about 19 miles southeast of Danzig, on the Vistula. The city has railroad and machine shops and large sugar works. Possessed by the Knights of the Teutonic Order in 1360, it became Polish in 1466 and fell into the hands of Prussia at the first partition of Poland in 1772. Pop. 16,894.

DIS (also **Orcus** and **Tartarus**), in Roman mythology the name given to Pluto, the Greek god of the lower regions. The word *dis* is akin to *divus,* and originally denoted merely godhead.

DISABILITY, in law, when absolute disables the party from holding public office or doing any legal act, and is usually the result of murder, outlawry or any outrage upon person or property. Aliens, infirm and aged persons dependent on public charity, are under this ban of incapacity, and in some Catholic countries those individuals who have been excommunicated. There is a disability termed partial that covers infancy, minority, lunacy and drunkenness. Also a term in accident insurance policies which, on account of inability to work or perform natural duties resultant from injuries, provides payment for the afflicted party. See ATTAINDER.

DISASSOCIATION. See DISSOCIATION.

DISASTERS OF THE WORLD, Notable. In man's unceasing war with Nature and gradual harnessing of her forces in the advance of civilization, Nature has shown frequent and often appalling signs of rebellion, exhibiting by a simple letting go of her tremendous forces how artificial and pitifully puny are man's greatest efforts, even yet. In the following classified list of "Great Disasters," one may gather the hopeful fact that in the domain of

"Earthquakes" alone mankind is absolutely helpless; that the dangers from "Conflagrations," "Floods" and "Shipwrecks" may be at least mitigated; and that a final conquest of "Plagues and Pestilences" is now at hand. In the preponderating prevalence of "preventable disasters," however, due to man's carelessness, ignorance of natural laws or disregard of human life, there is food for thought and radical remedial action.

CONFLAGRATIONS.

1666, Sept. 2–6 — London: 89 churches, many public buildings, and 13,200 houses destroyed; 200,000 persons homeless.
1825, Oct. 6 — New Brunswick: Miramichi Forest fires; 160 persons perished.
1835, Dec. 16 — New York: 600 buildings; loss $20,000,000.
1839, Sept. 6 — New York: $10,000,000 worth of property destroyed.
1845, April 10 — Pittsburgh: 1000 buildings; loss $6,000,000.
1850, July 9 — Philadelphia: 350 buildings; 25 persons killed; loss $1,500,000.
1851, May 4 — St. Louis: large part of city burned; loss $15,000,000.
1851, May 3–5 — San Francisco: 2500 buildings destroyed with loss of many lives and property loss of $3,500,000. June 22 of the same year a second fire occurred with a loss of $3,000,000.
1863, Dec. 8 — Santiago, Spain: Church of the Campania burned with loss of 2000 lives, mostly women.
1865, Feb. 17 — Charleston, S. C.: almost total destruction.
1865, April 2–3 — Richmond, Va.: large portion destroyed by Confederates.
1865, July 4 — Portland, Me.: almost complete destruction with loss of $15,000,000.
1871, Oct. 8–9 — Chicago: 3½ miles laid waste; 200 persons killed; nearly 100,000 made homeless; 17,450 buildings destroyed. In 1874 another fire in Chicago destroyed property to the value of $4,000,000.
1871, Oct. 8–14 — Michigan and Wisconsin: forest fires caused loss of 2000 lives.
1872, Nov. 9–11 — Boston: 600 buildings; loss of $73,000,000.
1877, June 20 — St. John, N. B.: loss, $12,500,000.
1876, Dec. 5 — Brooklyn theatre. 300 lives lost.
1889 — Seattle and Spokane: loss about $10,000,000 each.
1900, April 26 — Hull and Ottawa: loss $10,000,000.
1901, May 3 — Jacksonville, Fla.: loss, $10,000,000.
1903, Dec. 30 — Chicago: Iroquois theatre, 639 lives lost.
1904, Feb. 7–8 — Baltimore: 75 city blocks destroyed, covering 140 acres; loss $85,000,000.
1904, April 9 — Toronto: business district largely destroyed, loss $12,000,000.
1906, April 18 — San Francisco: four square miles burnt out; loss $350,000,000.
1908, Aug. 2 — Kootenay Valley, B. C.: town of Fernie and neighboring places destroyed.
1914, June 25, 26 — Salem, Mass: 1700 buildings destroyed; loss $14,000,000.
1916, Feb. 3 — Ottawa: Parliament buildings of Canada.
1916, July 30 — New York Harbor: Black Tom Island Explosion and fire; loss $11,000,000.
1917, Dec. 6 — Halifax, N. S.: Explosion of war materials and fire; 1500 killed, 4000 seriously injured, 20,000 rendered homeless, property loss $50,000,000.

GREAT FLOODS AND INUNDATIONS.

353 — Cheshire, England: 3000 persons drowned.
1103 — Flanders: town and harbor of Ostrud inundated by the sea and completely submerged.
1421, April 17 — Dort: 72 villages submerged, 100,000 persons drowned.
1530 — Holland: general inundation by failure of dikes; 400,000 persons drowned.
1617 — Catalonia: 50,000 drowned.
1889, May 31 — Johnstown, Pa.: town nearly destroyed and 6000 persons drowned.
1896, Japan: 27,000 lives lost, 60,000 homeless.
1900, Sept. 8 — Galveston: swept by tidal waves and more than 6000 lives lost; $30,000,000 worth of property destroyed.
1909–10 — The principal streets of Paris inundated by a flood in the Seine, the water rising 31 feet and 4 inches above normal.
1912 — Floods in Mississippi valley made 200,000 homeless and caused the loss of several hundred lives and $45,000,000 damage.
1913, March 31 — April 1: 415 lives lost and damage estimated at $180,000,000; Dayton, Ohio, nearly destroyed.
1915, July 12: China, provinces of Kwantung, Kwangsi, and Kiangsi; several thousand lives lost, and $90,000,000 damage.

GREAT EARTHQUAKES.

B. C.
425 — Eubœa made an island by an earthquake.
345 — Duras in Greece, and twelve cities in Campania buried.

A. D.
17 — Ephesus overturned.
79 — Pompeii and Herculaneum destroyed accompanying an eruption of Mount Vesuvius.
115 — Antiocle destroyed.
157 — Asia and Macedonia: 150 towns destroyed.
557 — Constantinople: thousands perished.
742 — Syria, Palestine and Asia: terrible loss of life.
936 — Constantinople overturned.
1268 — Cilicia: 60,000 perished.
1318 — England: greatest earthquake ever known there.
1456 — Naples: 40,000 perished.
1531 — Lisbon: 30,000 buried.
1626 — Naples: 70,000 perished.
1667 — Shamazi: 80,000 perished.
1693 — Sicily: 354 cities and towns destroyed; over 100,000 perished.
1703 — Jeddo (now Tokio): 200,000 lives lost.
1731 — China: 100,000 perished.
1745 — Lima and Callao demolished; 18,000 destroyed.
1755 — Lisbon: the great "earthquake," 50,000 persons and most of the city destroyed.
1797 — Cuzco and Quito destroyed; 40,000 buried
1822 — Aleppo destroyed; over 20,000 perished
1857 — Many towns in Kingdom of Naples destroyed; 10,000 perished.
1868 — Arequipa, Iquique, Tacna and Chincha and many other towns in Peru and Ecuador razed; 25,000 perished; damage $300,000,000.
1874 — Cities in Guatemala destroyed with great loss of life.
1883 — Java and neighboring islands desolated.
1886 — Charleston, S. C.: 41 lives and $5,000,000 worth of property lost.
1887 — Great shocks in southern Europe in the Riviera.
1906, April 18 — San Francisco and neighboring towns; earthquake followed by fire; over 1000 lives lost and $300,000,000 of property destroyed. The business section of San José was destroyed at the same time.
1908, Dec. 28 — Southern Italy was visited by a most destructive earthquake — many towns being almost entirely destroyed and 150,000 lives being lost. See EARTHQUAKES.

PLAGUES AND PESTILENCES.

B. C.
767 — A great plague prevalent through the world.
534 — Cantiage; multitudes affected.
461 — Rome; 100,000 perished.

A. D.
80 — Rome; 10,000 deaths daily.
167–189 — Roman Empire stricken with sickness throughout.
250–265 — Roman Empire again devastated; many towns depopulated.
430 — Britain; so many died from plague that not enough were left to bury the dead.
746–749 — 200,000 died at Constantinople of a contagious disease.
772 — Chichester, England; 34,000 died in an epidemic.
954 — Scotland; 40,000 perished.
1172 — Ireland; plague so severe it drove back English invaders.
1340 — The "Black Death" spread through all Christendom, causing unprecedented mortality.
1362–79 — Frightful mortality in western Europe.
1383 — The "Fourth Pestilence" in Ireland.
1485 — The "Sweating sickness" makes its appearance and rages at intervals for nearly 100 years, and with dreadful mortality.
1603–04 — 30,000 perished in London.
1611 — 200,000 died at Constantinople.
1625 — London was again visited; 35,000 died.
1632 — 60,000 died in an epidemic at Lyons.
1656 — At Naples 400,000 died in six months.
1664–65 — "The Great Plague" at London; 10,000 died.
1720 — Marseilles lost 60,000 by pestilence.
1741 — Yellow fever makes its appearance in New York.
1760 — Awful plague in Syria.
1773 — France devastated by "putrid fever."
1784 — 20,000 died of the plague in Smyrna.
1791–98 — Yellow fever appeared in various places on the Atlantic coast. New York, Philadelphia and Baltimore suffered especially.
1799 — At Suez the plague destroyed 250,000.
1805 — Yellow fever in New York; great fatality; 37,000 out of 70,000 fled from the city.
1814 — Terrible plague in Asia Minor, Palestine and Greece.
1817 — Asiatic cholera started at Calcutta; great mortality.
1818 — Vast numbers perished of cholera in Bombay, Ceylon, Siam and Malacca.
1819–22 — Yellow fever was again prevalent in the United States. The same year Tunis was half depopulated by the plague.

1823 — The cholera extended to the Mediterranean Sea.
1830 — Cholera appeared in England.
1831–2 — Cholera invaded Russia and France. In Paris the mortality was 15,000.
1832 — Cholera crossed the Atlantic, and appeared at Quebec, Montreal and New York, and passed thence to other cities. In the Canadian cities 2000 died, and in New York 3000.
1848–49 — Another visitation of cholera in England and America.
1865 — Large numbers died at various points in Europe, of cholera.
1878 — Yellow fever devastated many southern towns in the United States.
1884–85 and 1892 — Cholera again raged in various parts of Europe.

OCEAN DISASTERS.

1778 — Brig *Reprisal*, foundered off Newfoundland; lives lost, 130.
1780 — The *Saratoga*, sailed and never heard from; 170 lives lost.
1800 — The *Pickering*, never heard from; 90 lives lost.
1800 — U. S. Frigate *Insurgent*, sailed from Hampton Roads and never heard from; 380 lives lost; the greatest wreck disaster to the American Navy.
1814 — Sloop of War, *Wasp*, last spoken near the Madeira Islands, never heard from afterward; 140 lives lost.
1814 — Sloop of War, *Epervier*, sunk by collision with British ship *Bombay*, which passed on without offering assistance; 128 lives lost.
1837 — British transport *Albeuria*, foundered in the Gulf of St. Lawrence; regiment from garrison at Quebec on board; 525 lives lost.
1840 — Steamer *Dundee*, Gulf of St. Lawrence; 292.
1841 — The *President*, left New York and never heard from 120.
1854 — The *Arctic*, sunk by collision near Grand Banks; 322.
1856 — The Collins liner *Pacific*, sailed from Liverpool and never heard from; 288.
1857 — Steamboat *Montreal*, lost 15 miles above Quebec; 253.
1858 — Steamer *Austria*, burned in mid-ocean; 470.
1863 — Steamer *Anglo-Saxon* lost off Cape Race; 237.
1866 — Steamer *London*, foundered in the Bay of Biscay; 220.
1866 — Steamer *Evening Star*, foundered at sea; 250.
1867 — Royal Mail steamers *Rhone* and *Rye*; 1000.
1868 — The *City of Glasgow*, lost on the Grand Banks; 489.
1869 — The *Vicksburg*, off Cape Race; 65.
1870 — The *City of Boston*, sailed from New York and was never heard from ; 191.
1873 — The White Star liner *Atlantic*, lost; 585.
1873 — The *Ville du Havre*, collision in mid-ocean; 226.
1875 — The *Schiller*, wrecked in mid-ocean; 312.
1878 — The *Pomerania*, collision in English Channel; 47.
1881 — Steamer *Teuton*, lost off Cape of Good Hope; 331.
1883 — The *Cambria*, collision in North Sea; 389.
1883 — Steamer *Daphne*, turned turtle in the Clyde; 124.
1884 — Steamer *City of Columbus*, ran ashore off Gay Head Light, Mass.; 99.
1884 — Spanish steamship *Gijou*, collision off Finisterre; 150.
1884 — Bark *Pomona*, collision mid-ocean; 145.
1887 — Steamer *Kapunda*, collision off coast of Brazil; 300.
1887 — British steamship *Wah Yeung*, burned near Hong Kong; 400.
1889 — U. S. warships *Trenton*, *Vandalia* and *Mipsic*, and German ships *Adler* and *Eber*, wrecked by hurricane off Samoa; 147.
1890 — Steamer *Persia*, wrecked on Corsica; 130.
1890 — British steamer *Duburg*, wrecked in China Sea; 400.
1890 — British steamship *Ouelta*, foundered in Torres Straits; 124.
1890 — Turkish brig *Ertogrul*, foundered off coast of Japan; 540.
1890 — British steamer *Utopia*, collision off Gibraltar; 574.
1892 — Steamer *Namehow*, wrecked in China Sea; 414.
1893 — Anchor liner *Trinalria*, wrecked off the coast of Spain; 115.
1893 — H. M. S. *Victoria*, rammed in Mediterranean; 350.
1894 — Steamer *Norge*, wrecked on Rockall Reef in the North Atlantic; 600.
1895 — German steamer *Elba*, sunk by collision in the North Sea; 335.
1898 — U. S. Battleship *Maine*, blown up in Havana harbor; 260.
1898 — French liner *La Bourgogne*, collision off Sable Island; 584.
1904 — Excursion boat *General Slocum*, burned in East River; more than a thousand lives lost.
1905 — Japanese warship *Mikasa*; 500.
1907 — Steamer *City of Berlin*, off the coast of Holland; 150.
1908 — The *Ying King*, foundered off Hong Kong; 300.
1908 — The *San Pablo*, off the Philippine Islands; 100.
1909 — British steamer *Waratah*, left Port Natal and never heard from; 300.
1911 — From April 1, 1911 to April 1, 1912, there were 66 disasters at sea, with an aggregate money loss of $35,000,000; 1718 lives lost.
1912, April 15 — The White Star liner *Titanic*, collision with iceberg off the Grand Banks; 1503.
1914, May 29 — Canadian Pacific liner in collision with the *Storstad* in St. Lawrence River near Father Point; 900.
1915, July 24 — Steam boat *Eastland* capsized at wharf on Chicago River; 852.

DISBARMENT, the expulsion of an attorney, counselor or advocate from practice at the bar, this act depriving him of the privileges of his profession. A lawyer suffers this penalty if adjudged guilty of any misconduct of grave nature, as gross contempt of court, bribery, etc., or of notoriously evil character. In England this prerogative is reposed in the four Inns of Court, which have the power of admission to the bar, and in Scotland it is in the hands of the Faculty of Advocates, which is possessed of similar powers to those of the Inns of Court; but in the United States the courts alone have power to deal with an offender. Before disbarment the accused is given every opportunity to refute the charge, being allowed to defend himself in open court. A lawyer so dealt with may, at the discretion of the authorities, be restored when sufficient proof is brought them that there is no likelihood of a future offense.

DISCHARGE. (1) In architecture, the relieving part of a wall or a beam or other piece of timber from the superincumbent weight by means of an arch thrown over it. (2) In hydraulics, the issuing direction of water from a reaction or turbine wheel; as the outward discharge or Fourneyron turbine; the vertical discharge, or Jonval turbine; the centre discharge, etc. (3) In bankruptcy, a writing or document certifying that a bankrupt has satisfactorily passed the necessary forms and is thereby discharged from all further responsibility for the debts contracted by him previous to his bankruptcy. (4) In the military and naval services, a document given to each soldier or sailor on his dismissal from or quitting the service, in which are detailed full particulars as to his length of service, conduct, reason for discharge, etc. (5) In electricity it signifies the removal of the charge by communication between the positive and negative surfaces or poles, or with the earth. (6) In dyeing, a substance such as chloride of lime or nitric acid, used by calico-printers to remove a color. Suppose a white pattern is to be produced on a uniformly colored ground. The cloth is first dyed and then the pattern is printed with an acid, such as the tartaric, thickened with gum. When passed through a dilute solution of bleaching-powder, the acid decomposes it and the liberated chlorine destroys the color at the parts where the pattern was printed. Sometimes the cloth is prepared at the same time for subsequent pigment printing.

DISCIPLE, literally, one who learns anything from another; and hence the followers of any teacher, philosopher or head of a sect. In this sense the word is sometimes used in Scripture, as when we read of the disciples of Moses, of John, of Christ. Generally, however, it is used with reference to the last of these — the followers of Jesus. Sometimes all who received the doctrines of Christ are called disciples, but in a more limited sense, it is applied to the 70 or 72 persons who were his more immediate personal followers. Some-

times it is used as synonymous with apostle and is thus applied to the inner circle of the Twelve.

DISCIPLES OF CHRIST. The religious movement, whose representatives have come to be known as Disciples of Christ, or Christians, may be said to date its origin from the 'Declaration and Address' issued by Thomas Campbell, September 1809, and endorsed by his son, Alexander Campbell, who later became the leader of the movement. Thomas Campbell migrated from the northern part of Ireland in 1807 to seek a home for himself and his family in the New World. He located near Washington in western Pennsylvania. He was related by blood to the poet Thomas Campbell, and was a man of learning and profound piety. Being a minister in the Seceders' branch of the Presbyterian Church, he entered upon his labors in connection with that denomination immediately upon his arrival in this country. His experiences in seeking to assemble the scattered people of God of different names and creeds and to instruct them in spiritual things led him to realize more fully the evils of divisions among Christians. In his efforts to promote greater unity and co-operation among the members of these different sects, he found himself in conflict with the ecclesiastical authority under which he was working and was brought to trial before his presbytery, which censured him for his course. Mr. Campbell soon withdrew from the ecclesiastical authority under which he had been preaching but continued his ministry to an increasing number of people in private dwellings and wherever else an audience could be gathered.

In the 'Declaration and Address' referred to it was declared that "the Church of Christ upon earth is essentially, intentionally, and constitutionally one, consisting of all those in every place that profess their faith in Christ and obedience to Him in all things according to the Scriptures, and that manifest the same by their temper and conduct; and of none else, as none else can be truly and properly called Christians." While admitting the necessity of "distinct societies, locally separate one from another," this new declaration of independence declared that "there ought to be no schisms, no uncharitable divisions among them. They ought to receive each other as Jesus Christ also received them, to the glory of God, and for this purpose they ought all to walk by the same rule; to mind and speak the same things, and to be perfectly joined together in the same mind and in the same judgment." The address adds that "in order to do this, nothing ought to be inculcated upon Christians as articles of faith, nor required of them as terms of communion, but what is expressly taught and enjoined upon them in the Word of God. Nor ought anything to be admitted as of divine obligation in their church constitution and management but what is expressly enjoined by the authority of our Lord Jesus Christ and his apostles upon the New Testament Church, either in express terms or by an approved precedent."

In a word, the new movement had for its aim no less an object than the unity of Christians as they were one in the apostolic Church. In order to realize this consummation in harmony with the Lord's intercessory prayer they decided to reject all party names for those given in the New Testament, and all human creeds or formulas as authoritative or binding on the human conscience, or as bases of fellowship, and to take the word of God alone as their rule of faith and practice, and especially the New Testament, which was given for the guidance and instruction of Christians in their new life in Christ. Believing it to be necessary to return to the original foundation and practice of the Church in order to realize its unity and its power, they made a fresh study of the New Testament to ascertain (1) what was the essential creed or confession of faith required in the early Church; (2) on what conditions persons were received into its membership; and (3) what was the nature of their organization and government. They reached the conclusion that the confession of faith made by Simon Peter, on which Jesus declared he would build his Church, namely, "Thou art the Christ the Son of the living God" was the creed of Christianity and the essential faith, and that all those who would make this confession from the heart, being penitent of their past sins, were to be admitted by baptism into the membership of the Church; that baptism in the early Church consisted of the burial of a penitent believer in water in the name of the Father, and of the Son, and of the Holy Spirit, and that only such were fit subjects for baptism; that the form of Church government was congregational; that each congregation had its deacons and elders or bishops, the former to look after the temporal and the latter the spiritual interests of the Church. The Lord's Supper, it was found, was observed at first daily perhaps, but later weekly, on the first day of the week, in remembrance of Christ's suffering and death. Hence they practise weekly communion.

With this plea for the New Testament basis of fellowship, and a return to the original purity and simplicity of the gospel and church organization, the disciples have made a marvelously rapid increase. The movement at present in the whole world has reached a numerical strength of 1,307,502, having its colleges, its religious journals, and its missionary, educational and benevolent organizations, all of which are doing effective work. The American Christian Missionary Society is the national organization for home missions. The Foreign Christian Missionary Society, as its name indicates, has for its object the evangelization of the world. Besides this the Christian Woman's Board of Missions is an organization of the Christian women, which is doing mission work in both the home and foreign fields.

The Disciples of Christ raised $6,378,493.03 for current expenses in one year, while contributing a grand total of $2,294,522.08 for all religious purposes in that year. They are supporting missions in India, China, Japan, Africa, the Philippines, Cuba, Porto Rico, Mexico, Scandinavia and Turkey. Their aim is to be evangelical without being sectarian, and to be liberal without being latitudinarian. They attribute their success to their advocacy of Christian union, the simplicity and directness of their preaching and the freedom which they enjoy, untrammeled by human creeds or by any hierarchial authority.

The following statistics are taken from the 1918 Year Book:

Churches in the world	9,690
Communicants in the world	1,307,502
Bible schools (Sunday schools)	9,506
Bible school members	1,055,719
Ministers (white and colored)	6,200
MISSIONARY	
State missions	$362,669.37
American Christian Missionary Society	178,992.73
Christian Women's Board of Missions	518,446.34
Foreign Christian Missionary Society	550,386.85
Church extension	146,904.86
Ministerial relief	61,327.90
National Benevolent Association	225,174.76
Board of education	238,302.55
Association for Promotion of Christian Unity	5,354.51
Temperance board	6,962.21
Total for all missions	$2,294,522.08
Money raised for current expenses by the churches (many churches not reporting)	6,378,493.03
Grand total	$8,673,015.11

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DISCIPLINA, Arcani. The name given by John Dallæus to the secret discipline of the early Christian Church. The early Church had nothing to conceal. It began after the times of the Apostles, probably in the 2d century and was finally matured in the 4th century. It is supposed to have ceased about the 7th century, when the catechumenate was discontinued. Neander thinks that it had its source in Alexandria and spread east and west from there. At any rate the theology of Clement and Origen contain it to a considerable extent. The Church seems to have become a secret society. Many things concerning worship, belief and even the sacraments were revealed only to the initiated and were never referred to publicly. Worship was conducted with an air of profound mystery. As Th. Harnack says, «The mystical became mysterious and the liturgical became theurgic.»

Some Roman Catholic writers have made much of the prevalence of secret worship in the early Church, and have gone so far as to claim that there has been a secret tradition coming from the time of the Apostles and distinct from New Testament teachings.

The first part of the discipline dealt with the enemies of the Christian religion, the doom of Rome and the coming millenium and the end of the world. «The Apostolical Constitutions» refer to certain kinds of secret discipline. The Catechumens or Novitiates were not allowed to attend common prayers, nor were they allowed to have a sight of the celebration of the Lord's Supper, nor to attend the «feasts of love.» Baptism ended the novitiate. Another part of the discipline consisted in the preservation of many maxims and opinions in circulation only among the Christians. The secret discipline included as unmentionable: (1) The manner of administering baptism; (2) The manner of administering unction or confirmation; (3) Ordination; (4) The public prayers of the Church; (5) The manner of celebrating the Lord's Supper; (6) The Creed; (7) The Lord's Prayer; (8) The mystery of the Trinity. There are several conjectures as to its origin. Bingham thinks that it originated because of the plainness and simplicity of the Christian rites and the possibility of their giving offense. Others have thought that these mysteries arose largely through the influence of many pagans who crowded into the Church for political reasons in the reign of Constantine. Many had been devotees of the Eleusinian mysteries, and introduced some of their features into the Church.

Another theory is that it was adopted to withstand the Gnostic encroachments in doctrine and practice.

Still another theory is that it was developed as a means of the aggrandizement of the clergy. The rites could be performed only by holy consecrated hands, and common minds were unable to be instructors of the sacred doctrines and ordinances. The rites of the Church had no validity without the bishops.

The chief result of the secret discipline was the corruption of the simplicity and purity of church worship. It is thought by some that the doctrine of the baptismal regeneration from sin, and the doctrine of the actual presence of Christ in the bread and the wine are remains of the secret discipline.

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DISCIPLINE, in military and naval affairs, the general term applied to the prescription and enforcement of statutes, rules of procedure, orders, and regulations governing officers and men in service. Regimental discipline is chiefly maintained by the adjutant. He inspects and tells off all guards, escorts, and parties; keeps the regimental books; receives all garrison orders; superintends the drill and field movements, etc. In matters of discipline the adjutant-general is to the whole army what the adjutant is to a regiment.

DISCIPLINE, Books of, two books connected with the Scottish Church. The First Book of Discipline was drawn up by John Knox and four other ministers, and laid before the General Assembly in 1560. It was also submitted to the privy council; and though not formally ratified by them, it was subscribed by the greater part of the members. A similar document, called the Second Book of Discipline,' in the preparation of which Andrew Melville took a prominent part, was sanctioned by the General Assembly of 1578; and from that time it has been recognized as the authorized standard of the Church of Scotland in respect of government and discipline. It lays down principles regarding the relations of church and state; defines the provinces, duties, and relations of church-officers, the mode of their election, etc., and states the operation of the Presbyterian polity in the General Assembly, synods, and presbyteries of the Church of Scotland. See DISCIPLINE, ECCLESIASTICAL.

DISCIPLINE, Ecclesiastical. Church discipline is the method and means used by the authorities of the Church to preserve the purity and morale of its membership. The Old Testament basis for discipline is almost entirely found in the decalogue and the book of Leviticus. The administration of the law was largely

in the hands of the secular authorities. Sometimes, however, the seer or prophet took into his hands the power to rebuke and punish a king or leader. Some of the minor ecclesiastical punishments were applied by the priests.

In the New Testament, authority was derived from the decalogue and the ethical teachings of Jesus, especially Matthew xviii, 15–18. At first the Apostles were the administrators, later the deacons were empowered to assist them in minor matters. After the day of Pentecost, Church councils were held which gave added authority to discipline. The administrators of law were the leaders and supervisors of the work of the members or committees appointed by them. Later the bishop was the executor of authority whose power was checked only by the Church council. The punishments consisted almost entirely of exclusion, temporary or permanent, and anathema which was considered the extreme disgrace. Heresy punishment was often resorted to. In Paul's writings various classes of offenders are named. (1 Cor. v, 9–13; 2 Thess. iii, 6).

In the Nicene period to the time of the Emperor Constantine, discipline remained in the hands of the Church and rules were rather rigorously enforced, but there was no precise code governing the whole Church. In this period disciplinary canons were enacted and the system of penance developed, also the secret discipline or Disciplina Arcani (q.v.) developed.

After the adoption of the Church by the state, many ecclesiastical penalties were enforced by the state. They were of a much wider range than before the change and included confiscation of goods, fines, imprisonment, banishment and even the death penalty. Constantine, as Pontifex Maximus, claimed lordship over the whole Church, with the rights of a universal bishop. Under Constantine less attention was paid to moral conduct than to heresies and offenses against the corporate body of the Church. The death penalty was first imposed at Treves in 385, when Priscillian, a Spanish bishop, and six others, including a woman, were executed. Beginning with Augustine there was a conviction that heresy should be punished by death, and the schoolmen cited Augustine as being in favor of it.

The period of the Crusades witnessed a further development of discipline. The growth of the papal power and authority also tended to change its character.

With the establishment of the Inquisition by Innocent III at the 12th Ecumenical Council, another step was taken when it was not only planned to suppress heresy but to extirpate it. The bull, Unam Sanctam, promulgated by Boniface VIII, 1302, made obedience to the Pope necessary to salvation and declared that both swords were in his hand. The Council of Constance, 1415, reaffirmed the right of the Church to burn heretics, and condemned Huss and Jerome of Prague. The Council of Trent did not mention the death penalty, but did place great emphasis on the discipline of penance and the use of indulgences.

Luther never made a system of discipline. Zwingle left all right of excommunication to the state. John Calvin, however, was intensely interested in the subject, and in the second volume of his 'Institutes' (Book IV) devotes many pages to its discussion. The one great blot on the career of Calvin is his consent to the burning of Michael Servetus. In other matters of discipline the Reformed Churches and the Protestant Church of France followed the teachings of Calvin as set forth in his 'Institutes.'

The Lutheran Church government of Germany in modern days is a mere shadow as it is under absolute domination of the Imperial government. In America there are five general bodies of Lutherans besides several independent synods. No form of Church government is held to be essential and services and organization are carried on under Congregational, Episcopal and Presbyterian forms.

The Church of England in the Thirty-Nine Articles recommended excommunication, but left its execution to civil authorities because the Church was a state institution. The Westminster Confession (XXX) prescribes three forms of punishment — admonition, temporary suspension from participation in the Lord's Supper and expulsion. The Kirk Session, composed of the minister and elders, met once a week and judged and admonished the cases brought before it.

In American colonial times Church discipline was very strict in most of the colonies. It was due to this fact that the Blue Laws were enacted. For a time the Congregational Church was the state Church of some of the New England colonies. With the organization of the United States government and adoption of the Constitution the execution of ecclesiastical discipline was placed entirely in the hands of the churches unless the offense was a criminal act contrary to the civil law. In such a case both civil and ecclesiastical authorities gave judgment.

The Presbyterian Church is governed by the local session with the possibility of an appeal to the presbytery or the synod and a final appeal to the General Assembly (q.v.). Most of the Reformed and other Presbyterian churches have similar church machinery.

The Congregational Church is governed by its local body. Even the ministry is subject to it.

The Methodist Episcopal Church and most of the Methodist bodies have the general conference (q.v.) which is the sole lawmaking body of the Church. The judicial conference is the court of appeals. The annual conference is a local executive body, covering a considerable area. The governing body of the local Church is the quarterly conference. Discipline is twofold: admonition, and trial followed by expulsion if proved guilty. The defendant may appeal to a judicial conference and from that to the general conference which renders judgment through the adoption or rejection of the action of its committee on the judiciary.

There is a general tendency among many of the Protestant Churches to leave the matter of discipline alone and to make it a burden of the conscience as enlightened by the public ministry of the Church.

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DISCLAIMER, a renunciation, denial or refusal; a disavowal of claims, duties or liabilities. Specifically: (1) In the law of landlord and tenant, the direct repudiation of that relation by some act on the part of the tenant. Such

disclaimer may be verbal or written, but a mere verbal refusal to recognize the lessor as landlord is not sufficient; it must be made in a proceeding involving the rights of the landlord in the property, thus becoming a matter of record. (2) In the law of trusts, disclaimer is the refusal or renunciation of the office or duties of a trustee. No one is compellable to undertake a trust, and if so appointed has the right to determine whether he will accept or reject such office. The rejection or disclaimer is usually by a deed or other writing, but it may be by conveyance to other accepting trustees, or even orally. (3) In patent law, disclaimer is the renunciation, by amendment of specifications, of all or a portion of an inventor's claim to protection. (4) In equity, a plea put in on the part of a defendant in which he disclaimed all right or title to the matter in demand by the plaintiff's bill. It is a formal mode of defense and grants the defendant a hearing to determine whether he has any interest or connection with the matters in controversy, and, if he succeeds in proving that he has not, he is entitled to an order striking out his name as a party defendant.

DISCO, an island on the west coast of Greenland, under the parallel of 70° N. It is mountainous, reaching a height of 3,000 feet; and contains much excellent coal. Area 3,100 square miles. Godhavn, the seat of the Danish administration of South Greenland, is on the south coast.

DISCOBOLI, Cuvier's name for the lumpsuckers (*Cyclopterus*), besides which he placed the *Remora* (q.v.), now placed in another group. The term is still used for the family to which the lumpsucker (q.v.) belongs.

DISCOBOLUS, (1) in classical antiquity, a thrower of a discus or quoit; a quoit-player; specifically, the name given to the famous Greek statue of the quoit-thrower, the original of which is lost, but of copies that found in the Esquiline in 1761 and now in the palace of Prince Lancelotti, Rome, is the best example. (See DISCUS). (2) In ichthyology, a name given by Cuvier to his third family of soft-finned teleostean fishes, having the ventral fins under the pectoral. The name is derived from the ventral fins forming a disc on the under surface of the body, by which the fishes are enabled to catch hold on the points of rocks.

DISCOMEDUSÆ. See JELLYFISH.

DISCONTO - GESELLSCHAFT, The. The Disconto-Gesellschaft (Disconto-Gesellschaft in Berlin) was founded in 1851 as a "credit partnership," and in 1856 was changed into a limited liability joint-stock company under the name of "Direktion der Disconto-Gesellschaft," with a capital of 30,000,000 marks. Its founder was David Hansemann, later Prussian Minister of Finance. Its purpose and earliest activities were in the fostering of current account business and the underwriting of German state and local loans and railway shares. In 1890 a branch was opened in London, from which dates this institution's activities in overseas matters. In 1901, on the liquidation of the house of M. A. Rothschild & Sons of Frankfort-on-the-Main, a branch was established in that city, connection being made with the Rothschild Syndicate, with which it has since been largely identified. The interests formed with this group made the Disconto-Gesellschaft a prominent factor in the underwriting of many important national and railway loans, notably the state loans of Russia, Rumania, China and Japan. In addition, in connection with other interests, it was instrumental in the financing of the Kamerun Railroad Company and the Great Venezuelan Railroad, both speculative enterprises, and the latter eventually of great financial annoyance. As a national factor, the Disconto-Gesellschaft has lent its greatest support to industry through the promotion and financing of enterprises for the development of Germany's natural resources: the mining of coal and metals, smelting, iron and steel, potash, shipbuilding, electrical development, railways, fire and life insurance, etc. It assisted in the underwriting of the 10,000,000 thaler (30,000,000 marks) 5 per cent loan for the Krupp Works, in 1874 — the first instance in Germany of the issue of fractional form bonds secured by blanket mortgage and providing for common representation of the holders of these bonds. Beginning in 1881, this institution has established or participated in the establishment of 15 important banking institutions, having 87 branches, scattered throughout Europe, Asia, South Pacific, South America and Africa; and through communities of interest has banking connections in Hamburg, Leipzig, Bremen, Mannheim and Geestmunde, these latter having 51 branches and numerous other agencies throughout the empire. In 1914 it absorbed the A. Schaaffhausen'scher Bankverein, this latter still retaining its name and clientele. Close relations have been established with other important financial and industrial institutions, its directorate having (1908) representation on the boards of 92 corporations. The capital for the same year was 170,000,000 marks; surplus, 57,592,611 marks; and annual dividend, 8 per cent. The total capital power of the Disconto-Gesellschaft group amounted to 564,747,329 marks, of which 437,786,200 marks represented capital and 126,981,129 marks surplus. Consult Riesser, Dr. J., 'Die deutsche Grossbanken und ihre Konzentration' (1909); 'Germany's Economic Forces' (1913); 'Report on Co-operation in American Export Trade' (Washington 1916).

DISCOPHORA. See LEECHES.

DISCORD (Lat. *discors,* inharmonious), in music, is a combination of sounds producing irregular vibrations and technically called cacophony. It is a direct violation of harmonic laws and frequently spoken of as nothing but downright noise. It is often confused with dissonance (q.v.) which, however disagreeable the effect upon a hearer, obeys certain grammatical rules in the science of music, though never consonant. Celebrated composers have used discords purposely in their composition, requiring *macabre* character. Berlioz in his 'Damnation of Faust' is a case in point, while Wagner's scores bristle with cacophonies and dissonances.

DISCORDANCE, a term used in geology in two senses. First, Discordance of Bedding applies to unconformities (q.v.) in which the beds below the unconformable plane have undergone more folding than those above, so that they are not parallel. Second, Discordance of

Junction in rivers applies to hanging valleys. See UNCONFORMITY.

DISCOUNT (O. F. *discontes,* to count off), a deduction made from a quoted price, in consideration of a cash payment. Discount is also the amount deducted from the face value of a bill of exchange or promissory note, as the price for cashing it to the payee so many months or weeks before it is payable by the person who is primarily responsible for its payment. Bank discount is simple interest on the face value of a promissory note, and deducted from the face value, instead of being reckoned on the amount advanced. True discount is such an amount deducted, as would be simple interest on the amount advanced, for the time specified in the note. To specially favored customers, or buyers of large quantities, prices or percentages less than those listed may be charged; this is called trade discount. In transportation, discounts or preferential terms given to shippers are called rebates.

DISCOURSES AND HANDBOOK OF EPICTETUS. When Domitian banished the philosophers from Rome, in 94 A.D., one of the exiles was Epictetus, a former slave from Phrygia, now a professor of the Stoic philosophy. He removed his school to Nicopolis, a town of Epirus, and there, among other pupils, received a certain Greek author named Arrian, who has left memorials of the master's teaching in four books of 'Discourses' and in a summary called the 'Enchiridion,' or 'Handbook.' If these records tell the whole story, Epictetus paid little attention to the encyclopædic training of the sect, but drove straight at its ethical kernel. His lectures were pointed, sometimes extremely personal, alternating with exposition and satire and exhortation. In essence the Stoicism of the 'Discourses' is an outgrowth of the Socratic doctrine. Epictetus was fond of quoting these two dicta, adapted respectively from the 'Crito' and the 'Apology' of Plato: "But, O Crito, if so it is pleasing to the gods, so let it be"; and, "Anytus and Meletus are able to kill me, but not to harm me." These two sentences are given at the end of the 'Handbook,' with two others from the poets, as the *procheira,* or rules of conduct to be kept in hand for all the circumstances of life. The other two may be rendered in prose as follows: "Lead thou me, O Zeus, and thou, Destiny, whithersoever my place has been set by you; for ungrudgingly I shall follow; and if, being evil, I am unwilling, none the less I shall follow" — and, "He is the wise man among us and knows the divine, who has yielded nobly to Fate." There is in these saying a curious medley of fatalism and free-will. Stoicism was deeply influenced by science, and its universe is a mechanical system of causes and effects, God himself being only the finest form of material substance, interpenetrating and dominating the whole. In such a world there should seem to be no place for the moralist's distinction between the spirit and the body of man, no place for a free will; there should seem to be no meaning in the words good and evil, if man has no power of self-determination. But this ethical consequence of their physical theory Epictetus and the other orthodox Stoics did not draw. They asserted valiantly and vehemently that one thing was left free to man, his opinions. Cæsar, they said, can do what he will with my body, and circumstances may dispose of my life as they will, but neither Cæsar nor brute circumstance has any control over my opinions. It ought to follow that he is the free man who holds what general opinion of the world it pleases him to hold; but to this deduction Epictetus would not quite consent. The world is necessarily what it is; not what we think it — one great homogeneous effect of one cause — and therefore contains no real evil. It follows, then, that he alone is in the way of truth and freedom who resolutely, no matter what befalls him, holds to the opinion that this chain of events in which our life is bound is right and good — as certainly it is inevitable; yet practically no philosophers dwelt more than the Stoics on the inherent worthlessness of life. There is in such a doctrine a deep-lying paradox, an optimism overlaid upon a radical pessimism. Epictetus is at bottom a sad teacher, only less sad than his royal compeer, Marcus Aurelius; and this Stoic paradox, with its concealed melancholy, has come down from them, through the English Deists and the French *philosophes,* to the present day, tincturing the whole of modern life. To the student of the history of philosophy Epictetus is particularly interesting as representing the transition from Pagan Greek thought to Christianity. Though Epictetus, speaking as a physicist, would explain the Deity as fire, or the energy of matter, yet emotionally his attitude toward the first great cause is a fascinating link between the impersonal and philosophical theory of Plato and the religious and vehemently personal faith of a Clement of Alexandria or a Saint Augustine. A compendious way to present this distinction would be to set side by side the prayer of Socrates at the end of the 'Phædrus,' the prayer of Epictetus in the 10th chapter of the fourth book of the 'Discourses,' and the prayer of the Publican in the 18th chapter of Saint Luke. There are several English translations of the 'Discourses' and the 'Handbook'; perhaps the best is that by P. E. Matheson (Oxford 1916).

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DISCOVERY, in law, the act of a litigant who is called on to reveal or make known any matter or document which will aid in enforcing a right or repelling an unjust demand.

DISCOVERY, The, the name of several ships famous in the annals of exploration. (1) The vessel built by the East India Company in 1602 to determine the whereabouts of the northwest passage. She was originally commanded by Capt. George Weymouth, who sailed with a consort from Greenland, 2 May 1602. In 1610 Henry Hudson discovered the Hudson Bay in the same vessel, spending the succeeding winter in the ice. In 1611 the crew mutinied and set Hudson and some of his companions adrift, never again to be heard of. Later she was commanded by Sir Thomas Button (q.v.) who discovered Nelson's River and other points. In 1615 and 1616, the *Discovery* sailed with Baffin (q.v.) and Bylot, making important discoveries and explorations. (2) One of the vessels of Governor Knight's expedition of 1719 to the Arctic Circle in search of precious metals, lost on Marble Island, Chesterfield Inlet, and the

remains of which were discovered in 1767. (3) One of the ships of Capt. Christopher Middleton's expedition of 1742 in search of the northwest passage. (4) One of Captain Cook's vessels in his expedition to discover the northwest passage and in which, in company with the *Resolution*, Nootka Sound was discovered (29 March 1778). The expedition afterward proceeded to the South Seas, and in February 1779 Captain Cook was murdered at the Sandwich Islands. (5) One of the ships of Vancouver's expedition to the Pacific coast in 1791 when Vancouver Island was first circumnavigated.

DISCOVERY OF AMERICA. See AMERICA, DISCOVERY.

DISCRIMINATION, Sensible, or DIFFERENTIAL SENSIBILITY. A term employed in experimental psychology to denote our ability to distinguish likeness and difference among sense impressions. Thus, we are able to say that one tone is the same as another, one light is brighter or duller than another, one scent is stronger or weaker than another, etc. The psychology of sensible discrimination involves two distinct problems. The first is quantitative; we may compare sense-differences and determine the stimulus-differences which correspond to sense-differences. The second is qualitative; we may describe the mental processes involved in comparison and discrimination. The former is, historically, the older of the two problems; it is intimately related to the broader question of mental measurement (see INTENSITY OF SENSATION), and to the general correlation between stimulus and sensation-differences. See WEBER'S LAW.

The quantitative determination is of two kinds. We may seek, first, to find the just noticeable difference between two impressions. For example, two tones from about the middle of the scale and differing by a single vibration may be readily distinguished as different; but two tones differing by one-tenth of a vibration will be judged as the same. Somewhere between these two extremes of one and one-tenth a difference may be found that is just distinguishable. This difference is known as the just noticeable difference (or j.n.d.). We may seek, secondly, to compare two sense-differences; if, in a series of grays ranging from a light to a dark gray we find one that lies midway between the two extremes, then we, in effect, equate the difference between the light and mid-gray to that between the dark and mid-gray. Again, we may compare a difference just noticeable when two weights are placed on the resting arm with a difference just noticeable when the weights are lifted. The first kind of difference-comparison, that in which we halve a distance, is known as *direct* comparison; the second in which stimulus-differences are compared is called *indirect* comparison.

The determination of the just noticeable difference is not as simple, however, as we have made it out to be. The judgment of so small a difference is not easy, and the conditions are so complex as to require a rigorous method if the determination is to be valid. There are, for example, many errors to which the observer is liable; some of these are variable, such as practice, fatigue, habituation and expectation; others are constant and result from the spatial position or temporal order of the stimuli; still others are accidental in consequence of slips of attention, the physical condition of the observer, etc. It was the service of Fechner to work out the principles of method whereby these errors may be either eliminated or taken account of by mathematical treatment of the results. A number of stimuli are chosen, every one of which may be regarded as variable, or one may be constant (standard) and the others variable; these stimuli are arranged in regular order, or at hazard, in series; the order of presentation of every series is predetermined with regard to the variable errors; the temporal order and spatial position of standard and variable are reversed and the series repeated to eliminate the constant errors; the observer is carefully instructed as to what he is to do; and finally, a large number of observations are taken and the ultimate result calculated from the data obtained. The magnitude which represents the just noticeable difference is known as the differential limen, or DL. This may be defined as that difference which is judged less (the form of the judgment depends, of course, upon the nature of the difference) in one-half of a long series of observations, while in the other half the judgment is equal or greater. The form of the magnitude representing the DL may be absolute or relative, i.e., if in the determination of the tonal DL the pitch of the standard is 500 vs., and that of the variable which in 50 per cent of the cases is judged as higher is 500.25 vs., then the absolute DL is 0.25 v., and the relative DL is $\frac{0.25}{500} = \frac{1}{2000}$. The differential limen is an ideal value, it represents the most probable value, the mathematical equivalent of the difference which, if all sources of error were eliminated, would in fact be just noticeable. The just noticeable difference thus found has proved to be of signal importance for analytic psychology. The differential limen of the quality, intensity, clearness, duration, extent or any other attribute of sensation may be obtained and mathematically expressed, it furnishes the basis for the calculation of the number of discriminable qualities in vision and audition, and it is a significant aid in the analysis of both temporal and spatial perceptions.

We turn to the nature of the process involved in comparison and discrimination. When we set out to determine a just noticeable difference it is necessary to ensure a proper attitude on the part of the observer; he must not only be disposed toward the specific problem in hand, but, to avoid the difficulties of language, he must also have the form of the judgment literally put in his mouth. If, for example, we are to find the just noticeable difference of tonal pitch, then the observer will be given some such instruction as the following: "You will hear two tones in succession; you are to judge the second in terms of the first, and you are to report whether it is 'higher,' 'lower' or 'equal.'" The acceptance of this instruction by the observer determines the nature of his response; he knows what the categories of judgment mean, and the tonal impression automatically touches off the report. There is no comparison or discrimination in the popular sense of these terms; the procedure is as if the judgment were already made in the acceptance of the instruction and the sound itself releases

now this, and now that, form of report. Formerly, it was thought that in the event of successive impressions the judgment was mediated by an image of the first tone. When, however, the comparison is direct, as in the case described, no image or any other process than the bare impression itself is necessary. Indeed, in some cases a long-practised observer will judge by absolute impression, i.e., the report is released upon the appearance of the first tone. Even here, the second tone (which in such a case is the standard of comparison) is not necessarily imaged. Such a discrimination is, of course, far removed from those of everyday life. In the laboratory we reduce the mechanism to its lowest terms; in ordinary discrimination we are not disposed to observe a single attribute, and the discriminative consciousness must, on that account, be much more complex than the artificial conditions of the laboratory have shown it to be.

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DISCUS, among the Greeks and Romans a quoit of stone or metal, from 10 to 12 inches in diameter, convex on both its sides, sometimes perforated in the middle. The players aimed at no mark, but simply tried to throw the quoit to the greatest possible distance. It was sometimes furnished with a thong of leather to assist in the throwing. The throwing of the discus was a notable feature of the revival of the Olympian games at Athens in 1896. In these games the discus-throwing event was won by Robert Garrett of Princeton University, who far outclassed all the foreign competitors. The world's record in 1909 was 142 feet 10¼ inches, held by M. J. Sheridan, of New York. See DISCOBOLUS; QUOITS.

DISEASE. Disease is a lack or absence of ease; a condition of uneasiness or of pain. Pathologically, it is a collection of phenomena occurring constantly during life and after death, according to Savile; Huxley defined it as "a perturbation of the normal activities of a living body." Foster conceives of it as "Any departure from, failure in or perversion of normal physiological action in the material constitution or functional integrity of the living organism." It is a condition resulting from disordered physiological action and recognized by change in structure or in altered function. The area of altered anatomical structure, or the tissue changed through, for example, circulatory or eliminative failure, is called a lesion. The term disorder was formerly given to a group of symptoms without a discoverable anatomical lesion; but disorder and disease are now used as synonymous terms. Briefly and conveniently, then, disease is a departure from health, recognized during life through symptoms and physical signs.

Symptoms are subjective manifestations experienced by the patient, as for example, pain or buzzing in the ears. Physical signs are objective manifestations, discoverable by the physician on examination, such as heart murmurs or waves caused by fluid in the abdominal cavity or anomalies of pupils.

In the olden time before chemistry, biology and bacteriology had been developed, disease was regarded as a dynamic entity, which invaded healthy tissue, causing changes, and with a certain train of symptoms, and was so described, together with its cause and diagnosis, in the old "systematic medicine." Through the elaboration of experimental methods, the new school of pathology has been established and normal physiological processes, as well as the processes of the agencies resulting in disease, have become more thoroughly understood and definite causes have been confidently assigned.

Classification of Diseases.— An old classification divided diseases into *diathetic,* or those which are dependent upon a constitutional predisposition, or diathesis (q.v.), and *enthetic,* or those which arise from invading external causes. An example of the few diathetic diseases is hæmophilia (q.v.). This is a constitutional disease generally hereditary and characterized by frequent and prolonged hæmorrhages from very slight wounds, or from spontaneous rupture of blood vessels in the mucous or serous membranes. There is a greatly lessened plasticity to the blood and a degeneration of the coats of the blood vessels. Examples of enthetic diseases are plumbism (lead poisoning) and typhoid fever; the former caused by absorbing lead in solution in water run through lead pipes or from fresh paint; the latter caused by swallowing in food or water the typhoid bacillus.

Some make two divisions for purposes of classification: *germ diseases* and *non-germ diseases,* or *infectious* and *non-infectious* diseases. Germ diseases are caused by entrance into and growth within the body of bacteria (q.v.), which are vegetable spores. (See DISEASE, GERM THEORY OF). Many harmless bacteria naturally exist in the intestines; but most of the fatal diseases, including pneumonia, typhoid fever, tuberculosis, cholera and bubonic plague, are due to the entrance of the specific bacteria in each case.

Another classification, now little used, divides disease into *organic* and *functional,* the former being those in which tissue changes are demonstrated in the viscus or organ affected; while in the latter the organ fails to functionate properly, although itself exhibiting no lesion. But in functional diseases there are always distant lesions, owing to which, through reflex or directly conducted nerve action, functional disorder occurs.

Diseases are also classified as *idiopathic,* if arising from causes developed within the body; *traumatic,* if resulting from wounds or injuries; *acute,* if of sudden invasion and pursuing a brief, definite course; *chronic,* if pursuing a long course and persistent; *contagious,* if communicated from person to person; *constitutional,* if pervading the whole system, as blood-poisoning; *local,* if limited to a small area, as a boil; *congenital,* if existing before birth; *nervous,* if attacking some part of the cerebro-

spinal system or the nerves; *zymotic,* if due to the action of ferments.

For convenience of study, diseases are grouped according to the systems in which they cause disorder, as diseases of the respiratory system; of the digestive system; of the kidneys or genito-urinary system; of metabolism; of the locomotor system, etc. Very interesting and important is that group of diseases which are incident to *military service* and the group of *occupational* diseases. (See DISEASES, OCCUPATIONAL). The former includes "irritable heart," caused by forced marches in heavy marching order in those who are weakened by privation or illness, by dilatation of the heart, or by degenerated heart muscle. Syphilis, alcohol habit or tobacco favors its development. "Febrile exhaustion" is also seen in soldiers as a result of excess of acid in the muscles, and is characterized by remittent type of fever, weakness, nervous exhaustion and diarrhœa. "Feigned diseases" are especially trying to the regimental surgeon; for resort is not infrequently had to malingering to escape military duty and to enjoy the indolence of the hospital. Most frequently feigned are epilepsy, cholera, insanity, coma, blindness, deafness, heart disease and paralysis. The careful study of an experienced physician trained in neurology is often taxed to the utmost to uncover the fraud.

Diseases of occupation, or industrial diseases, include bronchitis, emphysema, pneumokiniosis, tuberculosis, lobar pneumonia, etc., among the respiratory disorders; cerebro-spinal hyperæmia, neuritis, fatigue neuroses, muscular atrophy, toxic paralyses and insanity, among the nerve disorders; eye diseases, from excessive light or heat, or from dust, gases, burns or accidents; skin diseases (dermatoses) such as scalds, burns, eczema among flax-pickers; or the result of lead, arsenic and other poisons; heart and blood vessel disorders from lifting or other excessive strain; disturbances of the digestive tract, as from poisoning with lead, arsenic, mercury, etc.; infectious disorders from pathogenic organisms in materials handled, including anthrax from hides and wool; glanders; anchylostomiasis (hook worm disease), common among miners, etc.; caisson disease, common among those who work in compressed air, and due to the sudden transit to the ordinary atmospheric pressure. Besides these, we have glass-blower's mouth, with swelling of the parotid gland. Women have increased susceptibility to industrial poisons, such as lead, phosphorus or mercury, similarly as to tobacco. Much depends upon the individual resistance of the worker, his general health and strength, his place of work, its duration and the processes employed. The fatigue neuroses mentioned include writer's cramp, telegrapher's cramp, piano-player's paresis, etc., to all of which alcohol habit, tobacco habit and mental anxiety predispose.

Climate has much to do with the prevalence of certain diseases. For example, cholera and yellow fever are found at sea-level in the tropics; malaria is found on either side of the equator, and is widespread; while sunstroke, mountain sickness and frost bite have been erroneously considered as due to climatic conditions. All that one can truthfully say is that climate is predisposing.

We formerly encountered a classification including "*house diseases,*" founded largely on the false belief that sewer gas caused certain illnesses. These diseases were due to direct contamination, as by insects, or to dust, the conservator of germs.

Propagation of Disease.— The propagation of diseases by insects has been receiving increased attention since 1894. Many mysterious, isolated causes of contagious diseases, as well as the progress of many epidemics, have been due to the facility with which certain disorders are transmitted by certain insects. The year 1894 is named because at that date Manson, of Dublin, appeared as a vigorous supporter of the theory that the mosquito was the cause of malaria. The theory had, indeed, been advanced by Crawford, an American physician, in 1807; again by Mott, of New Orleans, in 1848; and reasserted in 1883 by A. F. A. King, of Washington. Laveran, of Paris, who in 1880 discovered the *plasmodium malariæ,* advocated the theory in 1883. Through the studies and researches of the Italians, Bignami, Bastianelli, Grassi and Celli, also Pflügge, Pfeiffer and especially Manson, his pupil Daniels and Surgeon-Major Ross, of the British army, the discovery was completed in 1898, that the *anopheles* mosquito is the carrier of malaria. Reed, Carroll, Agramonte and Lazear, appointed in 1900 an American medical commission to investigate yellow fever in Cuba, determined the fact that the *Culex fasciatus* mosquito is the host for yellow fever (q.v.). Another species of the *Culex* is the transmitter of filaria. Elephantiasis has also been transmitted by the mosquito. Still more culpable is the common house fly (q.v.) in the transmission of disease. It conveys to man the infection of bubonic plague, leprosy, anthrax, Asiatic cholera, typhoid fever, smallpox and diarrhœa. The flea that infests the rat is the common carrier to man of the virus of bubonic plague. The itch mite conveys leprosy. The tick propagates Texas fever among sheep. The ant has carried bubonic plague as well as anthrax. The bedbug transmits leprosy, tuberculosis, cancer and relapsing fever, according to different observers. Roaches and house flies are carriers, not true intermediary hosts, of many disorders.

Obviously, all the propagation of disease by insects can be limited, though not entirely controlled, by proper measures to destroy all vermin and insects and prevent their multiplication as well as their attacks upon human beings. Those living in mosquito-infected districts should be protected by screens, especially at night. The larvæ of the mosquito can be killed by the use of a small amount of crude petroleum, which spreads easily over the entire surface of stagnant water. All pools, marshes and flowed lands should be drained, and the banks of ponds and streams should be altered so as to provide for a constant current of water, and obviate stagnation or occasionally flooded flats or margins. All water butts, eave-troughs and accidental receptacles of rain water should be emptied or treated liberally with chloride of lime. An epidemic of bubonic plague in San Francisco was terminated by killing the rats in the city.

Not unnaturally certain diseases are grouped together, as they occur largely during the first few years of existence, and during the last years of life, respectively, and are termed *dis-*

eases of childhood and *diseases of old age.* The former aggregation includes measles, whooping cough, chickenpox, rötheln, mumps, scarlet fever, etc.; while the latter embraces arterio-sclerosis, gout, deafness, cataract, etc. See CHILDREN, DISEASES OF; OLD AGE, DISEASES OF.

Diseases caused by perverted activity of the cell tissues are called "*autogenous diseases*"; but they should no longer be considered in a group by themselves. A familiar example is auto-intoxication (q.v.), better termed intestinal toxæmia, which is due to the retention in the colon and ileum of harmful bacteria, ingested with meat, fish and other albuminous food. Certain amino-acids are generated in the intestine which, being absorbed and carried in the blood stream, cause severe headache as well as much damage to the blood vessels and the heart muscle. A very small quantity of animal food, or a meatless diet, causes a change in the intestinal flora which relieves the condition.

Discoveries and Methods of Prevention.—The investigations of recent years have discovered the origin of bubonic plague, as has been said, that scourge which since the Dark Ages has reaped its harvest of millions of human lives; they have revealed also the cause of the fatal sleeping sickness, which is an organism carried by the tsetse fly to its millions of victims in Africa; also the spirochete of syphilis, that dread and deadly disease which invades nearly all organs and tissues in the body. Had Ehrlich achieved nothing else, his life would have been a blessing and his memory immortal because of the invention of Salvarsan (q.v.), which in such a large proportion of cases checks or cures the luetic scourge. Flexner's serum for treatment of cerebro-spinal meningitis; the surely progressing conquest of hookworm disease among countless thousands of "poor whites" and negroes, lazy and shiftless only because of prostrating anæmia caused by the bloodsucking intestinal parasite (*Nector Americanus*); the discovery of the bacillus of typhus fever by Plotz, of New York, in 1915, and the signal success of the serum therapy (q.v.) thereupon devised; these stand as the most brilliant achievements of a decade of years.

The forerunner of present day serum therapy was the use of diphtheria antitoxin, a procedure which has reduced the mortality of diphtheria from an average of 42 per cent to an average of 20 per cent, the deaths in some epidemics in cases in which the antitoxin was used falling as low as 12.5 per cent.

Vaccination against smallpox has been widely practiced as a protection and for terminating epidemics and reducing their incidence to the minimum. See VACCINATION.

The use of derivatives of the "ductless glands," suprarenal, thyroid, thymus, pituitary, corpus luteum and pineal gland, is increasing with the study of hemadenology, especially in treating certain anomalies of preadolescent life. Transitional, compensatory and abortive forms of pituitary disease, for example, are now recognized, and the individual sufferers, through proper treatment, are saved from progressing to acromegaly, gigantism, infantilism, adiposis, sex inversion and eunuchism.

Through the careful study of foods and of metabolism, valuable discoveries have been made. Guelpa, of Paris, devised and suggested the system which Allen, of Rockefeller Institute, aided by study of Naunyn, has elaborated into a practical dietary which is largely successful in treating diabetes (q.v.), now known to be an expression of diminished functional capacity of the pancreatic islets.

Beriberi (q.v.), a nutritional disease consisting of a multiple neuritis, characterized by a special train of symptoms, is very prevalent among sailors and natives of certain countries whose principal food is rice from which the pericarp has been removed. Restoration of the husk of the grain prevents further extension of the disease, and this, with other dietary expedients, ameliorates rapidly the condition of the sufferers. In the recent uncovering of the cause of beriberi, a train of exploration was begun which resulted in 1911 in the discovery, though not the isolation, by Casimir Funk, of the substances he calls "vitamines." They may not be amines, but the name will serve. They are essential to health, resembling in that way the lipoids of fats. Vitamines are found in meats, green vegetables, fruits and the pericarps of grain removed in milling for the sake of the appearance of the product. Pellagra (q.v.), a disease prevalent in the South, especially among negroes, characterized principally by muscular weakness, skin lesion and insanity, is a similar nutritional disease, in the opinion of most students, and is to be relieved by proper diet.

Since a large proportion of disease is avoidable, all reasonable prevention methods should be developed to the utmost. The first measure for a people to adopt for self-protection is a quarantine against the importation of disease by immigration. Records of the incoming vessel's health are examined at the quarantine station before the dock is reached, and inquiry is made concerning all cases of sickness or death on the voyage. Detention for a varying period may be ordered, all immigrants may be subjected to inspection and the boats may be fumigated. At the port of New York, for example, the stream of arriving immigrants is inspected for contagious eye diseases, hernia, and facial dermatoses; mental defects are noted as observed, and these patients are separated for treatment or further individual examination or for return to the country from whence they came. In time of epidemics of cholera and yellow fever, for example, much disease is prevented by strict quarantine regulations. Similar regulations have been enforced against people traveling from one State to another, or from urban to rural districts, as in 1916, during the epidemic of infantile poliomyelitis; and thereby the disease was confined to certain areas, and the number of possible contact cases was limited materially.

Constant preventive measures for the permanent population are taken by municipalities and States through various officials. Tenement-house commissioners enforce ordinances regarding cubic feet of air space, the number of windows proportionate to the size of each room, water supply, plumbing and sewerage, as well as the amount of ground to be left uncovered by the building erected thereon. Factories and workshops are supervised under mercantile inspection laws in order that air-space, ventila-

tion, water supply, plumbing, sewerage, light and fire protection may all be ample; State meat inspectors examine and approve or destroy carcasses of animals slaughtered for food, tagging accepted portions.

State and local health boards cover a wide field of protection through their activities, with milk inspections including determination of specific gravity, butter fat, percentage and contamination, as well as control of sanitary features of herding and stabling; licensing and inspection of midwives; suppression of nuisances, including the production of noxious fumes or smoke, as well as maintenance of fly-breeding refuse, contamination of streams, etc.; abolishing of the common drinking cup and the common towel; prohibiting spitting in public places; requiring sanitary conditions in barber shops; more adequate control of tuberculosis; protection of public and private water supplies; control of communicable diseases, and promotion of child hygiene.

Protection from and prevention of disease through control of communicable disorders are secured by thorough notification and very early report by physicians and other persons, and an immediate study of sources, in order to trace to the origin and eliminate the source in each instance, vaccinating and immunizing thoroughly and repeatedly, and establishing local headquarters where needed, furnishing diagnostic service and also serums and vaccines.

Child hygiene, a measure of prime importance, is promoted by conducting infant welfare campaigns, with traveling exhibits, lectures by members of the department staff, demonstrations and talks by trained nurses, interviews with mothers' clubs and parent-teacher associations and general public meetings. Infant welfare stations are established where mothers are instructed by station nurses and babies receive care. Child welfare exhibits are prepared for county fairs and similar gatherings, at which are distributed pamphlets containing instruction in disease, its cure and its avoidance. "Better baby" contests are inaugurated and motion picture films on child welfare are shown. Older sisters, on whose shoulders fall the care of the babies, are organized into "Little Mother Leagues," with pledge cards and certificates of membership, and information is communicated at these meetings.

In several cities prevention of disease among public school children is aided by daily inspection of all pupils by teachers, who set aside those apparently ill for skilled examination and disposal by the medical school inspectors. All eyes are closely scrutinized; throats are inspected for adenoids and enlarged faucial tonsils; teeth are surveyed and treated if necessary, and a daily hot meal is served to the under-nourished pupil.

Modern medical discoveries have resulted in reducing the amount of internal medicine used, and in increased attention to diet, exercise, baths, diversion and rest and natural and hygienic modes of life. Preservation of infant life, conservation of health by avoidance of morbific agencies and increase of longevity are the aims of medical practice to-day.

See BACTERIA; BACTERIOLOGY; CLIMATE IN TREATMENT OF DISEASE; DISEASE, GERM THEORY OF; GERM; IMMUNITY; OLD AGE, DISEASES OF; SENILITY; VITAL STATISTICS; WATER, ITS RELATION TO DISEASE, and articles on the various diseases.

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DISEASE, Germ Theory of. Before beginning a detailed consideration of this subject an attempt should be made to arrive at a clear understanding as to just what is meant by the "germ theory" of disease. According to this conception disease in either animal or vegetable forms may be the result of the introduction and subsequent growth of minute organisms, all of which are microscopic in size, and which, quickly increasing enormously in number, produce in the bodies of their hosts more or less profound chemical alterations, accompanied by the formation of poisons. In the beginning the true character of these so-called "germs" was in great doubt, but with the progress of knowledge it was discovered that they are for the most part of a vegetable nature, though it is unquestionably true that some of the most common of the infectious processes are induced by animal organisms. Such morbific agents, being thrown out in the secretions and excretions of their hosts, not uncommonly infect all objects with which the diseased bodies are associated, and spreading in this way frequently convey the infectious maladies that they produce to other similar related organisms.

It should be observed that the large number of infectious diseases, the causative agencies of which have so far been discovered, are, as compared with some affections, without exception only mildly contagious, while some are only conveyed by means of inoculation or by intermediate hosts. On the other hand, certain maladies — such as smallpox, measles, chickenpox, scarlet fever and German measles — are of a highly contagious character, and it is noteworthy that no one has as yet been able to detect the poisons that produce them, and we are still in complete ignorance as to whether they are of an animal or vegetable nature; so apparently minute and imponderable are the causative factors in these maladies that it seems not impossible that they may after all be the result of the growth and development of certain morbific agencies that belong neither to the animal nor vegetable kingdoms, or conceivably of ferments capable of growth and of multiplication.

At this point it may be insisted that much real progress has been made in the study of this most important and interesting subject, and that our knowledge has advanced to the point where we are no longer limited by speculation — it having been proved beyond the possibility of doubt that many diseases are produced by what are called "germs," and that, therefore, it is no longer necessary or strictly accurate to use the word "theory" in this connection — and that we are justified in asserting without qualification that many infectious maladies are the result of the life-activities of certain minute organisms. Notwithstanding that the word "theory" no longer has any proper place in defining or describing the science of the causation of disease by minute microscopic forms, the convenience of the term and the difficulty of finding a short and satisfactory substitute therefor has led to its retention, and we therefore find that the expression "germ theory" is still

commonly employed. We should never forget that while the word "germ" is usually thought of as being synonymous with the term *bacterium*, that, as already mentioned, it should not be regarded as being strictly limited to such low vegetable forms, and that it may be and is quite as appropriate to so characterize minute *animal organisms*, a small number of which have been shown to be the causative factors in the production of disease.

History of the Germ Theory.—A few words as to the evolution of the "germ theory" may not be without interest.

As to just when the idea of the production of disease by minute living forms of life was first conceived, we are in complete ignorance, the origin of the view being lost in the mists of preceding ages, but that it was held to a greater or less extent in the past there can be no doubt. On the other hand there seems to have been little or no attempt to define the nature of these supposititious poisons until the beginning of the 17th century. In the year 1671 the learned Jesuit Athanasius Kircherus wrote a remarkable book in which he described, with the aid of a very primitive microscope, the discovery of "a countless brood of worms not visible to the naked eye" in a variety of decomposing substances such as milk, vinegar, cheese, etc. He likewise discovered in the blood and in the pus from the buboes of those suffering from the pest many similar organisms, which were regarded by him as the causative factors in this malady. While it was later recognized that these objects were nothing more than cells normally present in the fluids mentioned, this investigator's writings are of great interest as being the first records which we possess of a microscopic study of the body fluids in disease, and at the same time the first attempt to assign to supposed micro-organisms a rôle as the causative factors in a definite affection. The idea having been once clearly formulated it naturally grew, but its further development was slow, as it wholly depended on improvement in technique —particularly on greater perfection in the microscope, for which science is largely indebted to Robert Hooke and Anthony van Leeuwenhoek. Likewise the lethargy of the Middle Ages not yet having been shaken off, further advances were necessarily slow,—this being not a little accentuated by the criticism and stubborn opposition that all great discoveries invariably encounter in the beginning. Indeed, we find that this subject made no great advances for almost a century, the next publication of any importance in this connection having been a book by Plenciz in 1762. This very able writer made no discoveries, but deserves great credit for having first clearly pointed out the illogical characteristics of the prevalent notions of the etiology of disease and for having strongly called attention to the fact that the causation of contagious diseases could only be logically explained by the assumption that they are the result of a living poison.

With the progress of time considerable advances were made in the study of low vegetable forms, particularly by Müller, Ehrenberg, Dujardin, Perty, Cohn and Naegeli.

In view of subsequent discoveries, it is of great interest to note that Donné appears to have been the first observer who definitely attributed the causation of an infectious disease to a specific low microscopic form,—he having in 1837 described and figured a *vibrio*, which he stated he had only found in the secretion from syphilitic lesions, the organism being in form and length much like the *spirochæte*, which only within recent years has been recognized as the causative factor in the production of *lues*. Curiously, the first organism definitely shown to be the morbific agency in a contagious malady was a low form discovered by Bassi in a silkworm disease known as *muscardine*.

Following this the pathogenic organisms of a number of different affections were recognized in quick succession, the *sarcinæ* of *gangrene* having been described by the brothers Goodsir in 1842, the organism of the skin disease called *favus* by Schönlein in 1839, the *Trichophyton tonsurans* which causes *ringworm of the scalp* by Gruby in 1843, the *microsporon furfur*, which produces *Pityriasis versicolor*, by Eichstedt in 1846, the supposed germ of *thrush* by Gruby, Langenbeck and Berg in 1839–41, and the *bacillus* of *anthrax* by Pollender in 1849.

Following this there was a considerable period during which no new discoveries in this direction were announced, though in the meantime bacteriology was elevated to the dignity of a science through the epoch-making investigations of Pasteur. This great observer during the same period demonstrated that all fermentations arose from the presence of micro-organisms. He likewise showed that suppuration in wounds is to be looked upon as an analogous process, and that by shielding abrasions and cuts of all kinds from contamination by bacteria pus formation could be prevented,—thus laying the groundwork for the subsequent brilliant demonstrations by the great English surgeon Lister of the practical uses to which this knowledge could be put.

Beginning about the year 1880 and for the next decade a large number of diseases were shown to be the result of the life activities of certain bacteria, the most important of which was the demonstration by Koch that *tuberculosis* is produced by a bacterium.

This period is also noteworthy from the fact that Laveran first showed that animal micro-organisms may also produce disease in man, he having discovered in 1880 that malaria is due to a germ of this character. Subsequently it was found that a number of affections are likewise to be ascribed to the action of minute parasites of a similar kind, the most important of which is *sleeping sickness* in man, which is produced by a *trypanosom*, and that closely related organisms occasion diseases in many of the lower animals.

Space will not permit even a résumé of the discoveries that have been made in connection with this subject during the last 30 or 40 years, it being only possible to state that nearly all infectious processes have been associated with some definite organism, and that there is every reason to believe that there is a *contagium vivum* for those infectious maladies the specific "germs" of which have not as yet been discovered. Inasmuch as the great bulk of diseases in man and the lower animals, as well as in the vegetable kingdom, are of an infectious nature, it will be seen that the investigations which have shown their relationship to micro-

organisms is of the first importance, and that it forms the basis of almost the entire science of medicine. Not only have our discoveries in this connection enabled us to formulate rational methods of treatment, but they give us the key to what is even more important — the prevention of disease. So far have we advanced in the latter direction that it is probably no exaggeration to say that we are in a position to-day to prevent at comparatively small cost three-fourths of all the sickness from which the human being suffers, and that the blind fatalism and stupid ignorance of a great majority of mankind alone prevent a consummation so devoutly to be wished — all of which is at bottom due to our study of the relationship of "germs" to disease.

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DISEASES, Occupational. The complexities of modern life and modern living have had much to do with the development of a large class of diseases which, because they are associated with, and in many instances clearly derived from, certain trades and occupations have received the name of occupational diseases and in very recent years have been carefully investigated and classified as such. The work of W. G. Thompson in this field has been extensive and illuminating. While these diseases have been more carefully investigated recently than they formerly were, many of them are not new to literature and medical science; many others are however the direct consequence of trades and occupations which have been born and developed as the result and consequence of modern discoveries in chemistry, physics, metallurgy, electricity and other sciences. The first publication upon this subject which was given to the world, at any rate to the modern world, was by Ramazzini, a careful Italian observer, who in 1713 published a small book relating to the disastrous effect of their respective occupations upon metal diggers, gilders, chemists and tin workers. We must not forget that in these early days this disastrous effect was due perhaps as much to uncleanly ways of living and to unhygienic shops and houses as to poisonous and unhealthy conditions in the work itself. This does not signify that such unfavorable conditions have been entirely removed from modern industrial plants; if they had there would not be so many occupational diseases. But the baneful effect of certain occupations has been clearly recognized and sometimes by legal enactment, sometimes by the force of public opinion, the disease-producing conditions have been removed or minimized, compensation for disease or injury sustained while at work guaranteed, and even the hours of work lessened so that exposure and hazard are becoming less and less noteworthy and the responsibility for disease and injury is becoming shifted more and more to the shoulders of the laborer himself. At the rate at which industrial conditions are now improving and the demands which organized labor is insisting upon, the risk which attends many of them ought soon to disappear; moreover it is not unlikely that some of the occupations will have become so unprofitable that they will disappear. For the best interests of society let us hope that employers will become less rapacious and laborers less unreasonable and exacting; that employers will more and more provide their shops and factories with hygienic conditions and safety appliances, and that the laborer will become less careless, less indifferent to safety and health, and more careful to avoid preventable disease and accident.

According to Thompson's arrangement, occupational diseases may be caused by (1) toxic substances; (2) mechanical irritants; (3) temperature or air pressure; (4) overuse of nerves and muscles; and they may be acute, resulting in sudden death, or chronic continuing through years and serious conditions to a fatal issue. The following classes of disease may be noted: (1) Those which are due to irritant substances, including toxic metals, gases and fluids, irritant dusts, including those which are insoluble and inorganic, those which are soluble and inorganic, and organic dusts and fibres, also those which are due to germs and miscellaneous irritants. (2) Diseases which come from harmful surroundings, including modifications of air, temperature and light, and electric shock. (3) Miscellaneous diseases from occupations involving more than one hazard, such as mining, dyeing, pottery making, also including diseases of the blood, skin, nerves, eyes, ears, nose, throat, mouth, bones, joints, bladder, etc. The irritant substances which cause the diseases may enter the body in the pure form or as salts of various substances, as dusts, fumes or mixed metal solutions, inhaled in the form of sharp particles in the nose or throat, or less frequently by absorption through the skin. These substances not only cause mechanical irritation but, as in the case of such poisonous metals, as mercury, arsenic, lead, silver, antimony, etc., they have their specific effect upon the nerves, arteries, kidneys, mucous membrane, bones, etc., the effect being sometimes quickly fatal and sometimes fatal through prolonged chronic diseases, especially chronic nephritis, the poisons being chiefly eliminated by the kidneys so far as they are eliminated at all. Some of these substances have a specific action on certain tissues, thus antimony is a specific poison to the nose, pharynx, bronchi, stomach and intestines. Brass dust causes what is known as brass-founders' fever or ague, though one soon acquires immunity from the effect.

The influence of sand blasting is very injurious to the mucous membrane of the mouth, throat and nose, and upon the bronchi and lungs, unless the face is protected by a suitable mask. Workers in bronze, chromic acid, cobalt, copper, manganese, platinum, silver and zinc may be poisoned by dust or fumes, but those who work in gold, iron, steel, nickel and tin are not injured except by the dust, or by solder which may be used in working them. The effect of toxic gases is local or general, acute or chronic, and they are eliminated by the lungs or kidneys.

The list of poisonous gases which produce disease or death is a long one, among them being bromine, carbon bisulphide, dioxide and monoxide, chlorine, the vapor from essences, extracts and essential oils, ether, formaldehyde, gasoline, naphtha, iodine, wood alcohol and turpentine, and the gas from phosphorus and sulphur. The inhalation of ammonia and ammonium chloride produces cough, sneezing, catarrh and bronchitis. The clothing of those

who work in amyl alcohol and amilin may become so saturated that unconsciousness and death may follow prolonged inhalation of the gases as they are volatilized. Benzine vapor is very poisonous and may produce an acute or chronic disease.

Workers in dyes, petroleum, alkalis and carbolic, nitric, hydrochloric and sulphuric acids suffer mostly from the direct effect upon the mucous membrane of the respiratory organs. Those who work in nitro-glycerine soon acquire immunity, as it is readily absorbed. The injury from organic dust and fibre which occurs for example, to those who work in grist mills, grain elevators, sugar réfineries, etc., consists in mechanical obstruction in the respiratory passages, in the bruising of the mucous membrane, in the inhalation of soluble poisons and germs and in the irritation of the skin, eyes, ears and mouth. Other substances which may cause irritation by being received into the body in the course of one's occupation and which may be mentioned in this relation are all those which are connected with the work of miners, asphalt, cement, emery, glass and stones, metals and earths which are ground or crushed or polished. The cleaning occupations are very productive of disease through inhalation, including the gathering of ashes and garbage, street cleaning, carpet cleaning, and the mechanical treatments of cotton, felt, feathers, flax, hemp, fur, horn, bone, shell, horsehair, jute, rags, straw, tobacco, wool and rubber. The harmful occupations which are due to bad physical surroundings are those of workers in caissons and tunnels, in which the so-called caisson or compressed air disease is produced, and also conditions in which there is air concussion or air rarefaction. In this category must also be included those occupations in which the conditions of heat, cold, moisture or light are excessive or abnormal.

If we turn our attention to specific trades and occupations we see that farmers, though working in the open air and, under ordinary circumstances, having the best chance for immunity from disease, are nevertheless very often victims of disease of the digestive apparatus and sufferers from bad teeth owing to the large quantities of indigestible, poorly cooked and imperfectly masticated food which are eaten by so many of them and the failure to give proper attention to their teeth.

Fishermen and sailors are also sufferers from similar diseases and from pneumonia and tuberculosis owing to exposure to bad sanitation at home and on shipboard, bad habits, and too exclusive a diet of fish, salt pork and other cured foods.

Those who contract anæmia, tuberculosis and many diseases of the lungs, teeth, mucous membrane and skin in connection with their occupation, owing to bad air or to irritating dust or gas which they inhale, include tanners, blacksmiths, miners, bakers, millers, knife grinders, and many others.

The diseases from working in metals, with serious or fatal poisonous effects and injuries to both soft and hard tissues, affect workers in copper, lead, arsenic, phosphorus, mercury, zinc, tin and brass.

Railroad men, especially those who work on trains, have the usual ailments which come from exposure, such as rheumatism, eye strain and other eye troubles, and kidney disease from excessive shaking, while they are continually in danger from serious accidents.

The workers in tunnels and caissons and in other places where the air pressure may be as great as four or five atmospheres suffer seriously with their blood and nervous system, air being forced into the nervous tissue which is not always dislodged, even by careful decompression, when the victim returns to ordinary atmospheric conditions.

Those who live in a rarefied atmosphere or who ascend, like aviators and mountain climbers, to great altitudes, often suffer from air hunger, from pneumonia and other diseases of the respiratory organs, and from heart troubles. The experience of the great European War shows however that immunity may quickly be gained even for great heights, and ability to work severely and think rapidly and intelligently may be acquired.

Workers in chemicals are particularly sensitive to diseases of the lungs and skin and include bleachers who work in chlorine, sulphur and acids, aniline dye workers, starch makers and workers in ammonia and many other chemicals. Athletes and those who work in strained and trying positions like miners and tunnel drivers suffer from diseases of the heart and lungs. In the case of pugilists, gymnasts, circus performers and other professional athletes, periods of training are often followed by periods of the grossest and coarsest dissipation, and collapse and early death are the frequent and logical result.

Rupture and aneurism are not of uncommon occurrence in occupations in which there are great and sudden strains, frequently repeated, porters, blacksmiths, draymen and longshoremen often being victims of these accidents, and they are the more likely when, as is so frequently the case, the tissues are debilitated by syphilis or other venereal disease.

Those who are exposed to loud noises, like boiler-makers and riveters, are sufferers from deafness, and hundreds and thousands of the soldiers in the European War, particularly those who are in the artillery service, suffer in this way. Those who work under intense light, particularly if it is shifting and uncertain, suffer from eye diseases, especially impairment of vision. The workers under intense electric light in power houses and elsewhere can hardly escape the bad effects of this unusual experience. Brewers and saloon keepers suffer, in great numbers, from the excessive use of alcohol, the lungs, liver and kidneys being the organs most often attacked. Flat feet, varicose veins and constipation are acquired by those who are constantly on their feet, like cooks, waiters, house servants, policemen and salesmen. Glassblowers, potters, and band players on brass instruments often suffer from emphysema of the lungs, a distressing and often serious trouble due to rupture of the lung tissue and escape of air into the chest cavity. Those who work in india rubber and inhale carbon bisulphide and those who inhale benzine and turpentine vapors often suffer from headache, poor sight and hearing and intestinal cramps.

Indigestion is a very common ailment with those whose eating and drinking habits are irregular, notably cabmen, various classes of

public officials, and commercial travelers. Instrument players, typewriter operators, stenographers, bookkeepers, and all others who are constantly writing are subject to cramps and palsies. The disease called scrivener's palsy was once very common in England and has its counterpart in the classes of workers above mentioned. Sedentary workers, shoemakers and tailors are great sufferers from hæmorrhoids, constipation and indigestion, as might be expected, from insufficient use of their muscles and want of stimulus to the circulation.

The list which has been given is far from complete but is sufficient to show the susceptibility to disease from ordinary occupations and emphasizes the importance of good habits and proper diet in all these pursuits. These diseases in many instances are preventable, and inasmuch as health is the most valuable asset of the industrial worker, it behooves him to look after it with the greatest care. No constitution is so rugged that it may not be broken down prematurely and with absolute certainty if the laws of hygiene are persistently disregarded.

ANDREW F. CURRIER, M.D.

DISEASES OF CHILDREN. See CHILDREN, DISEASES OF.

DISEASES OF THE EYE. See EYE.

DISEASES OF OLD AGE. See OLD AGE, DISEASES OF.

DISEASES OF PLANTS. See PLANTS, DISEASES OF.

DISENTIS, dē'zen-tīs, Switzerland, a village in the canton Grisons, situated on the Hither Rhine. It is about 31½ miles southwest of Reichenau, and 3,600 feet above sea-level. The Monk Sigisbert, a disciple of Saint Columba, is supposed to have founded a large Benedictine monastery here in 614. Pop. 1,691.

DISESTABLISHMENT, specifically the depriving a church of its rights, position or privileges as an established church; withdrawing a church from its connection with the state. A bill for the disestablishment and disendowment of the Irish Church was introduced into the British House of Commons by Gladstone 1 March 1869. It was passed by Parliament within a few months of its introduction but did not take effect till 1 Jan. 1871. In the session of 1914 an act providing for the disestablishment and disendowment of the Church of England in Wales was passed by Parliament, but owing to the outbreak of the European War its enforcement was postponed until the conclusion of peace.

DISFRANCHISEMENT, the act of depriving a person of any privilege, liberty, franchise or immunity, such as depriving a member of a corporation of his corporate rights. It is distinguished in this case from "amotion," which refers to the removal of an officer of the corporation from office without affecting his membership. Another instance is the act of depriving a person of the rights and privileges of citizenship. This term is often applied to the act of depriving a citizen of the right to vote; and in Great Britain to the act which deprives a constituency of the right to return a member to Parliament whether through a redistribution of seats or as a result of bribery and corruption in a constituency, the suspension by the House of Commons on the recommendation of the judges who tried the case of that constituency's right to return a member. See ALIENS; ELECTORAL QUALIFICATIONS; SUFFRAGE; ELECTIONS; NATURALIZATION; VOTES, VOTERS, VOTING; UNITED STATES — SUFFRAGE IN THE.

DISHONOR, the refusal or omission of the drawee of a bill to accept, or of the acceptor of a bill, or of the maker of a promissory note to liquidate the obligation on its maturity. There are generally three parties in a bill or note transaction, the holder, the drawer and the person by whom the bill or note is payable, whether he be the maker or acceptor of it. In case the bill or note is dishonored the holder must at once notify the endorser and the drawer, if the paper be a draft or bill. Then the drawer, if there be funds of his in the hands of the drawee, will have an opportunity of withdrawing them. If a banker refuses to pay a customer's check while holding an account of that customer sufficient to meet such check he makes himself liable for damages.

DISINFECTANTS, agents used for destroying or rendering inert the germs of infectious diseases. It has been amply proved that a large number of diseases are of microbic origin, and when these low forms of microorganisms are introduced into the bodies of susceptible individuals they multiply and thereby become capable of producing certain diseases which are called infectious. Any agent capable of destroying these organisms is a disinfectant or germicide, and through disinfection we have a powerful and effective means of controlling these diseases and checking the spread of them.

In order to disinfect thoroughly we must first identify the source of infection. In the eruptive fevers, such as measles, scarlet fever, smallpox, etc., the infectious germ comes directly from the body of the patient suffering with the disease, attaching itself to clothing, bedclothes, etc., and to objects handled by the infected person. The same is true of infectious skin-diseases, such as barbers' itch, ringworm, etc. In pneumonia, tuberculosis, diphtheria and whooping-cough the sputum and the breath carry the germ of infection; in cholera the alvine discharges and possibly the vomits; in typhoid fever infection is generally due to the specific germ found in the discharges from the bowels; in malaria, anthrax and elephantiasis the germ is found in the blood and is transferred by biting insects; in hydrophobia it occurs in the saliva, spinal cord and brain; in gonorrhœa in the urethral discharges, etc. Some of the infecting agents do not multiply outside of the body, while others under favorable conditions are highly procreative. While, therefore, the object of disinfection would be accomplished by destroying all infected material, where this is not admissible it is necessary to subject it to a process of disinfection inimical to the life of the infecting germ. This must be complete and thorough. The selection of an appropriate disinfectant for each disease is the result of laboratory research. A culture of a germ is made in a medium best adapted to its propagation and by experimenting with various germicides one is found which proves most destructive to the germ in the shortest possible time. The best and cheapest disinfectant is heat, particularly moist heat. There is no infectious germ known that

can survive boiling water continued for a time — longer or shorter, depending on the germ.

In the use of heat various kinds of mechanical apparatus for both dry and moist (superheated steam) heating are used. Boiling infected clothes with or without the addition of a chemical disinfectant is a popular means of disinfection. Where it is impossible to use either of these agents resort is had to fumigation with gaseous vapors of the disinfectant. Cold (freezing) is a natural disinfectant, but fails in the case of typhoid germs, which have been known to survive freezing for 103 days; and the same is true of the tuberculosis germ. Camphor, medicated papers or the burning of incense may clear an odorous atmosphere impregnated with sewer-gas or fumes of decomposing animals or vegetable matter; but these are not true disinfectants.

Of late the utility of steam disinfection has been forcibly demonstrated, and most cities and quarantine stations have established plants for this process. Clothing, bedding, etc., known or believed to be infected are placed in chambers or cylinders and subjected to superheated steam (220° to 230° F.) for 20 or 30 minutes. This thoroughly disinfects all infected material. Dry heat is not so effective. A practical disinfectant for many domestic purposes, both inexpensive and easy of application, is chlorinated lime in the proportion of six ounces to a gallon of water. All typhoid or cholera stools, likewise the sputum of pneumonia or tuberculosis patients, are rendered innocuous by it in less than 30 minutes, if used in equal quantity with the material to be disinfected. It may also be used as a spray, particularly for cellars, and the dry chlorinated lime is useful in the case of privies and garbage cans. Carbolic acid in a 3-per cent solution — that is, in the proportion of four ounces to a gallon of water — is one of the best. It does not stain or burn and is sufficiently powerful to disinfect floors and woodwork, although for this purpose a 5-per cent solution is generally used. For clothing the 3-per cent bath is used and the immersion should be not less than one hour. The cresols are cheaper and still more effective, a 2-per cent solution being equal to a 5-per cent solution of carbolic acid. Borax is a good disinfectant for open sores, but should be used only under the direction of a physician, as it frequently develops poisonous effects through absorption into the blood. Potassium permanganate is an effective disinfectant for water tanks and pipes. It is non-poisonous, comparatively cheap and possesses the power of destroying the noisome odors of putrescence. It depends for its action upon its generation of nascent oxygen. Another bactericide of great oxidizing power is hydrogen peroxide. Corrosive sublimate in proportion of one part to 1,000 parts water is not only an efficient disinfectant, but a powerful insecticide as well. It can be applied to woodwork, walls, floors, etc., but its corrosive action on metal renders its uses limited on sewers, drains and the like. Milk of lime or common whitewash, so highly recommended by the German government in the cholera epidemic of 1892, is a ready and efficient means of disinfection. This may be prepared by sprinkling with water a quart of quicklime in a suitable vessel and, when the lime is reduced to a powder, adding three or more quarts of water, allowing the mixture to stand. It may then be applied with a brush to walls, floors, etc. Drains are flushed and all excreta from infected cases treated with equal parts of lime solution.

The use of chlorine and sulphurous gases is objectionable because of their irritating qualities. Sulphur fumes to be effective must be accompanied by moisture. Steam from a boiling kettle will do. A more modern disinfectant is formaldehyde, made by subjecting methyl-alcohol to oxidation and commonly known in commerce as formalin, which is a 40-per cent solution of formaldehyde. It is readily soluble in water, does not destroy clothing or furniture and is virtually non-poisonous. It is used for disinfecting surgical instruments, for the washing out of sinuses and of indolent and foul ulcers and for the disinfection of dwelling-rooms. An approved method of using it for the last-named purpose is to pour 10 ounces of formalin upon 4 ounces of potassium permanganate. This should be done in a sufficiently large vessel to obviate spattering, and the vessel should be set upon a brick or stone base. To be effective the temperature of the room must not be less than 65° and a humidity of 65 degrees is desirable. This moisture may be provided by boiling a tea-kettle in the room for a time before the gas is liberated, and this will serve also to warm up the room. The proportions given are for a space of 1,000 cubic feet. Larger rooms will require more formalin. Another method which is highly recommended is the following: Make a mixture of three parts of 40-per cent formalin and one part of carbolic acid. Eight ounces of this mixture will be required for each 1,000 cubic feet of space and the room must remain closed for 12 hours. A sufficient number of sheets are saturated with the mixture, each sheet holding about six ounces, and they are hung on lines strung across the room, free of the walls and floor. A so-called «solid» form of formaldehyde has been placed on the market, with a container in which it is burned. If sufficient formaldehyde is used for the size of the room this device is convenient and effective, as the resulting gas quickly penetrates all cracks and crevices and renders the air clean and pure, besides destroying all infectious germs.

Most of the metallic and acid disinfectants are more or less objectionable on account of their destructive action to the skin and tissues. Osmic acid, bromine and iodine are useful in their respective places. The relative disinfectant values of the various germicides in common use, based on the efficiency of carbolic acid on the typhoid germ as 1, is as follows:

Corrosive sublimate	400–3,540
Hypochlorites	146–220
Iodine water	100
Iodine trichloride	94
Bromine water	64
Potassium permanganate	42
Chlorine water	28
Silver nitrate	15
Formic acid	5.7
Benzoic acid	5.0
Sodium bisulphate	4.1
Cresylic acid	3.7
Copper sulphate	2.0
Lactic acid	1.8
Eucalyptol	1.2

In all cases of infectious or contagious diseases disinfection should be complete; articles infected should be burned, boiled or disinfected and not buried or thrown into sewers

before being treated with a proper disinfecting agent, for infecting germs have been known to lie dormant for years. In disinfecting a room in which infectious disease has been housed a thorough mechanical cleansing should be carried out after a preliminary disinfecting. The walls should be carefully brushed with a vacuum cleaner and the floors and woodwork scrubbed with hot water and soap, finishing with a formalin solution to which has been added a little glycerine. A fresh coat of paint or varnish on the woodwork and new wall-paper or calcimine placed on the walls complete the list of essential precautions. The ceiling may be regarded as safe. (See also the article DISINFECTION). Consult Christian, M., 'Disinfection and Disinfectants' (London 1913); Rosenau, M. J., 'Disinfection and Disinfectants' (Philadelphia 1902).

RICHARD FERRIS,
Editorial Staff of The Americana.

DISINFECTION, popularly speaking, the process of destroying the micro-organisms which produce the class of diseases known as infectious or contagious diseases. These diseases are communicated in various ways. Leprosy, anthrax, rabies, the plague and diseases of the genital system are communicated by the direct contact of a healthy body with a diseased body. The dry germs of measles, chickenpox, smallpox, scarlet fever and tuberculosis float freely in the atmosphere and being inhaled may find lodgment. The tiny drops of mucous emitted in coughing, sneezing, talking, laughing and singing may convey the germs of influenza, diphtheria, whooping-cough, phthisis, tuberculosis, spotted fever and glanders. The disease germs of typhoid fever, dysentery and cholera are abundant in the urine and excreta of the patients, and may be spread by spattering when the vessels are cleansed, or they may find their way into wells and reservoirs through the wash of rain. The germs of anthrax, lockjaw and malignant œdema settle upon the soil and are likely to make their way thence into open wounds. Malaria, yellow and spotted fevers, the plague, sleeping sickness and some others are transferred from a sick person to a well person by mosquitoes, fleas, gnats or other biting insects. Flies carry on their legs, and undestroyed in their intestines, the germs of many diseases and distribute them everywhere, particularly on human foods which are also fly foods: and most kinds of food are exceptionally good breeding ground in which many disease germs multiply with great rapidity. It is to be remembered also that infection is not likely to cease with the primary contact. A germ originally in the soil may be carried for a long distance in a bit of mud on a shoe and thence transferred to a shoe-brush, or to some caressing animal, and so start on a long journey in which it may menace any person who is in a state of health susceptible to attack by that particular disease. It is to be understood, of course, that the vast majority of persons, although equally exposed, are not infected and diseases do not develop in them. The office of disinfection is to protect the susceptible ones.

Practically, then, disinfection is the freeing of articles or substances from the adhering or inhering disease germs, either by removing the germs bodily, or by destroying them where they are. The first method employs mechanical devices, such as filters for drinking-waters, the use of vacuum cleaners, scrubbing wall-paper with stale bread and woodwork with soap and hot water, etc. In the same category would be the coating over of germs with whitewash, calcimine, paint or varnish. The destruction of germs where they are is a wider field and calls for intimate knowledge of the germ to be destroyed and of the particular substances which will be fatal to it and the conditions under which such remedies must be applied to be effective. For a general description of these agents and the methods of using them, see the article DISINFECTANTS.

The United States government has published several very complete and valuable pamphlets on disinfection and the proper use of disinfectants: Farmers' Bulletin 345 (1913); Hygienic Laboratory Bulletin 82 (1912); Public Health Service Bulletin 42 (1911); and Public Health Service Reprint No. 287 (1915). In this encyclopedia individual prophylaxis against contagion is described under each infectious disease and can best be consulted in its proper place. See ANTISEPTICS; BACTERIA; DISEASE; GERMICIDES.

DISINTEGRATOR, a machine in which various substances are pulverized, crushed or disintegrated through concussion by beaters projecting from the faces of parallel metallic discs revolving in contrary directions. There are disintegrators for ore and for grain, and one form is used for mixing mortar.

DISLOCATION, the displacement of one bone from another with which it forms a joint. Thus by dislocation a limb is said to be put out of joint. Dislocations are the result of either disease, accident or congenital malformation. The displacement may be either partial or complete and cases are classified as simple, when the skin remains unbroken, and compound where a wound lays bare the bone; when a fracture of the bones and injury to important blood vessels aggravates the case, the dislocation is said to be complicated.

The general treatment of dislocations consists in reduction, that is, drawing back the displaced joint into its socket. The contracted muscles oppose this reduction, and sometimes their spasmodic action has to be overcome by the administration of chloroform or ether. Up to the year 1870 or thereabouts the reduction was generally effected by extension, that is, by pulling out the displaced limb and stretching the restraining muscles until they are exhausted, when the bone would generally slip back into its place with an audible snap.

Of late years, however, reduction by extension has been to a very large extent given up in consequence of the general adoption of reduction by manipulation. This method, known it seems from ancient times, but curiously neglected, consists in executing certain complex movements of the dislocated limb which effect the return of the displaced bone to its socket by ingeniously utilizing its unruptured attachments and evading the opposition of the muscles, by ingenuity rather than by force. It is particularly applicable to the hip, which, as it is commanded by the strongest mass of muscles in the body, always presented the most formidable obstacles to the old method. The first paper on

this subject which attracted general attention was by Dr. Reid of Rochester, N. Y. (1851); and in 1869 Professor Bigelow of Boston published a careful and exhaustive discussion of injuries to the hip, with such full and clear directions for the manipulation method, as to secure its general adoption in the case of this joint by surgeons in Great Britain as well as in America. The method, however, had been described and used in France and elsewhere, though with less care and precision, in the earlier half of the 19th century.

In cases of congenital dislocation of the hip bone and other congenital misplacements of the bones, manipulation, intensified into powerful massage, has been developed practically to a wonderful extent by numerous surgeons.

DISLOCATION (in geology). See FAULT.

D'ISLY, Duke. See BUGEAUD DE LA PICONNERIE, THOMAS ROBERT.

DISMAL SWAMP, Great, a tract of marshy land, beginning a little south of Norfolk, Va., and extending into North Carolina; containing 750 square miles; 30 miles long, from north to south, and 10 miles broad. This tract was entirely covered with trees, with almost impervious brushwood between them, but it has now in part been cleared and drained and is devoted to agriculture. In the midst of the swamp is Drummond's Lake, seven miles in length, the scene of Thomas Moore's 'Lake of the Dismal Swamp.' The Dismal Swamp was originally part of the Virginian estate of George Washington; and it was he who superintended the digging of the "Washington ditch," the first step in its reclamation. In 1899, the Dismal Swamp Canal, connecting Chesapeake Bay with Albemarle Sound, first opened in 1828, and to the close of the Civil War a famous historic waterway, was reopened for navigation. It extends from the village of Deep Creek, Va., to South Mills, N. C., a distance of 22 miles; and is one of the most important links in the chain of inland waterways extending along the coast from New York to Florida. A marked advantage of the restored canal is that it enables shipping to avoid the dangers of Cape Hatteras; another is that it will furnish the means of inland and protected navigation for the smaller vessels of the navy and the revenue service. Although only 22 miles long it opens up 2,500 miles of inland navigation. The improvement of this canal cost the United States government nearly $1,000,000. Little Dismal and several smaller swamps are along the coast of North Carolina; area, about 2,000,000 acres.

DISMAS, Saint, according to ancient legends based on doubtful authority, the name of the penitent thief who died on the cross beside Jesus Christ; that of the impenitent thief being given as Gesmas.

DISPART (Lat. *dispartire,* to divide apart), the difference between the semi-diameter of the base ring at the breech of a gun and that of the ring at the swell of the muzzle. On account of the dispart the line of aim makes a small angle with the axis, so that the elevation of the latter above the horizon is greater than that of the line of aim. In modern guns the dispart is of no consequence on account of the present placing of the sights on the mount and not on the gun.

DISPENSARY is literally a place where medicine or food is weighed out for distribution; in our own day the term is applied to a charitable institution where medical and surgical aid are given without charge to those who desire or need them. Such dispensaries are found in most large towns of the United States and Europe. In the Old World they originated in the monasteries. The modern dispensary system in England was inaugurated in London in 1687. The oldest institution of that kind in the United States was opened in New York in 1795.

Figures compiled by the American Hospital Association show that the number of dispensaries has grown from 200 in 1904 to over 2,300 in the fall of 1916. Of these about 1,000 were dispensaries for the sick poor, treating general diseases, while the remaining 1,300 were public health dispensaries established for the relief and particularly the prevention of such communicable diseases as tuberculosis.

The dispensaries, founded and maintained for the relief of the sick poor, have been greatly abused in Europe as well as in the United States and to a large extent have become the propagators of pauperism. In 1897 it was estimated that in Albany 21 per cent, in Brooklyn 31 per cent and in New York 71 per cent of the population (inclusive of suburban patients) applied for free treatment in the dispensaries. In 1899, with the view of remedying matters, it was enacted in New York State that dispensaries were only permitted to be operated under license, and among other reforms, applicants for relief were compelled to sign a declaration of their inability to pay; but it is estimated that, in spite of that and other measures taken, only 50 per cent of those aided are in need of what is practically gratuitous medical relief. In Boston in 1909 it was estimated that those who attended free dispensaries equalled over 25 per cent of the entire population of the city. The weakness of the position is that public clinics are attended by fee-paying students and doctors eager for dispensary experience and that for their sakes patients must be obtained, who, as an equivalent for free treatment, are expected to appear before a medical class, submit to public examination and be the text for a medical or surgical lecture.

Consult Goldwater, 'Dispensary Ideals: a Plea for Dispensary Reform' (Philadelphia 1909); Report of the Boston Dispensary for 1911, and those of New York State Board of Charities for 1878, 1897 and 1905; and articles in the *Maryland Medical Journal* for March 1907, "Suggestions for Reorganization of Hospital Out-patient Departments"; and *Canadian Journal of Medicine and Surgery* for January 1912, "The Out-patient Clinic."

DISPENSATION, in canon law, is the relaxation of a law in a particular case: it is an act for which the lawgiver is competent as regards laws enacted by himself or by his predecessors to whose powers he succeeds. It differs from absolution, for it not only forgives the illegal act but validates its results. It is claimed for the Supreme Pontiff that he can dispense in matters where the *jus divinum* springs from a human act of will, as in vows and promissory oaths (Liguori): in such case casuists hold that the Pope does not do away with the *jus divinum* but removes the ground of the

obligation of oath or vow: in the words of Aquinas, "He determines what is pleasing to God." The claim of power in the Pope to do this rests on the power granted to Saint Peter, of loosing and binding. Dispensations were for centuries granted by bishops to their subjects, not only from diocesan or provincial statutes, but even from laws imposed by a general council or by the Pope; but since the time of Innocent III (d. 1216) the right has been claimed as a prerogative of the Supreme Pontiff. Bishops by their ordinary power can dispense from the laws and statutes of their own diocese and from the general laws of the Church by virtue of powers delegated by the Pope, as in most vows and in the laws relating to fasts, abstinences, observance of holidays, etc. In 1534 Henry VIII decided that for his realm applications should no longer be made to Rome, and this assumption of ecclesiastical rights he conferred on the archbishop of Canterbury. Dispensations are generally obsolete in the Anglican Church, but bishops have power of issuing special marriage licenses and permitting non-residence and the holding of two benefices.

DISPERSION, an optical term applied to the angular separation experienced by the component rays of a pencil of light on emerging from a refracting medium, whose surfaces are not parallel to each other, as in the case of the common prism. The nature of this phenomenon was first clearly expounded by Sir Isaac Newton in 1666 and is accounted for by the different speeds of light of different wave-lengths in the same refracting medium. The refractive index of a transparent medium is different for different kinds of light. Thus, when white light passes through a given prism, the rays of different refrangibility of which it is composed are bent by different amounts from their original common direction. They are said to be dispersed. The dispersion for the given prism depends upon the difference of the refractive indices of the extreme rays of the visible spectrum. It varies with the substance and the angle of the prism. The relative breadth of any two parts of the spectrum varies with the substance of the prism. This constitutes the so-called irrationality of dispersion. In general, rays of short wave-length are more refracted than rays of long wave-length, but in some refracting media this law breaks down in part. This is known as anomalous dispersion. The term false dispersion is applied to the scattering of light by reflection from motes suspended in a transparent medium. See LIGHT.

DISPLAYED, a heraldic term used to describe the position of an eagle or other bird with its wings expanded.

DISPOSSESS, in law, to put out of possession, to dislodge and evict; to deprive of actual occupancy, particularly of real property. Dispossess *proceedings* are begun against a tenant who is then served with a dispossess *warrant,* and ejectment from the premises follows. See EJECTMENT AND EVICTION.

DISPUTATIONS, Historic. Public debates on religious questions are of very ancient origin according to the tradition in the Midrash which represents Abraham as holding a debate with Nimrod. In 150 B.C. a debate was held in Alexandria before Ptolemy Philomater on the comparative pureness and completeness of the Jewish and Samaritan text of the Old Testament. Later, Jews and Romans debated. In the early Christian Church debates were held with the Jews. Two are of especial prominence: the debate of Athanasius with Zaccheus and the debate of Justin Martyr with Trypho, the Jew. In the 13th century the Jews and Christians of Italy publicly disputed various questions. A great disputation was held at Paris, 25–27 June 1240, in the presence of Queen Blanche, mother of Louis IX, and a great number of priests and rabbis. Another famous debate took place at Barcelona, 20 June 1263, on the question whether the Messiah had appeared or not. It was at the royal palace in the presence of James I of Aragon and his court. Benedict XIII presided over a great debate which was held with great pomp and numbers at Tortosa beginning in February 1413 and ending November 1414. It was probably the longest debate in history, having 69 sessions and many debaters. The councils of the Church were often nothing more than disputations. The establishment of universities and the granting of degrees further extended the scope of the public debate. Many of the institutions held a weekly debate where the entire faculty assembled and a master presided. The presiding officer proposed theses which were attacked in turn by various masters while the bachelors defended the thesis of their master. The Middle Ages laid great emphasis on disputations. "Such intellectual tournaments in which the students were taught to defend a thesis against attack, did more to enable them to grasp a subject than the mute and solitary reviewing and cramming of our modern examinations can possibly do. That method brought into play all the excitement of a contest, the triumph of success, and the disgrace of defeat, in order to emphasize the value of what had been learned, together with the importance of an alert wit and constant readiness to use it." (F. Paulsen). After the Middle Ages the weekly disputations declined in use and were largely succeeded by the Seminar system. The candidate for the doctorate published a thesis or theses and defended them against all comers, a custom which still prevails in some European universities. It was in keeping with this custom that Martin Luther posted his 95 theses. The famous Leipzig disputation of Andrew Bodenstein of Carlstadt against John Eck and of Luther against Eck covered a period of 22 days, both sides claiming the victory. In Switzerland the public disputations of the Reformation began with that of Zürich, which opened 29 Jan. 1523. More than 600 men of eminent rank and scholarship were present. Zwingli debated against Faber and won. In December 1524 Stör, a priest, debated against clerical celibacy and the same month Farel also conducted a disputation. Another disputation in which Eck represented the Papal party was held at Baden in 1526. Haller of Bern and Œcolampadius of Basel opposed him. The treatment of the representatives of Bern and Basel was such that their home supporters were dissatisfied and another disputation was arranged for which took place at Bern 7–27 Jan. 1528. Zwingli was present and there was no notable debater on the other side. After the printing presses became more common the public debate was largely succeeded by the printed debate made

especially noteworthy in the Marprelate and Deistic controversies. A great disputation was held in Geneva in May 1535 in which Viret and Farel took part against Jean Chapuis. Farel and Viret also debated at Lausanne in October 1536, in a public disputation with the Papal party. In 'The Cyclopædia' edited by Abraham Rees, we find that "The Port Royalists take occasion to observe that nothing gives so many different lights and openings for discovering the truth as disputation. The movements of a mind, employed singly in the examination of any subject, are usually too cool and languid; the mind needs a certain degree of heat to awake its ideas. Now, by the oppositions in dispute we come to find wherein the difficulty lies, and the vigor the mind has acquired enables us to surmount it." Some debates have occurred in America which attracted wide attention. Alexander Campbell, founder of the Disciples Church, was a great debater. At Cincinnati, Ohio, 13–21 April 1829, he debated with Robert Owen of Lanark, Scotland, on the "Evidences of Christianity." Again at Cincinnati, 13–21 Jan. 1837, he debated on the Roman Catholic religion with Rt. Rev. John B. Purcell, bishop of Cincinnati. Mr. Campbell also debated with Rev. Nathan L. Rice, at Lexington, Ky., 15 Nov. to 2 Dec. 1843, on Christian baptism. The report of the debate fills a volume of 912 pages. Cincinnati was the place for another noteworthy debate, 1, 2, 3 and 6 Oct. 1845, on the "Sinfulness of Slavery." The debaters were both Presbyterian clergymen of Cincinnati, Rev. J. Blanchard and Rev. Nathan L. Rice. A public debate was held at Genoa, N. Y., beginning 28 Dec. 1847 and ending 5 Jan. 1848, between David Holmes, a Methodist, and John M. Austin, a Universalist, on the doctrines of the "Atonement," "Universal Salvation" and "Endless Punishment." A debate was held near Cincinnati in 1860 on the "Coming of the Son of Man," "Endless Punishment" and "Universal Salvation" between Erasmus Manford of Saint Louis, editor of a magazine, and Benjamin Franklin of Cincinnati, editor of the *American Review*. A nine days' debate was held at Vienna, Ill., in August 1868, covering "Baptism," the "Work of the Holy Spirit," the "Discipline of the Methodist Episcopal Church" and "Human Creeds." The debaters were Clark Braden of the Church of Christ and George W. Hughey of the Methodist Episcopal Church. A large volume of nearly 700 pages was probably the only result of the debate. There have been many informal debates between Arminians and Calvinists, Methodists and Baptists, Episcopalians and Dissenters when the discussions were not printed. The American political debates have furnished one of the most brilliant contributions to the forensic history of the United States.

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DISRAELI, Benjamin. See BEACONSFIELD.

D'ISRAELI, Isaac, English author: b. London, 11 May 1766; d. Buckinghamshire, 19 Jan. 1848. His father, Benjamin D'Israeli, was the descendant of a family of Spanish Jews which had settled at Venice in the 15th century to escape the persecutions of the Inquisition. He was educated at Enfield and Amsterdam. In 1791 appeared the first volume of his 'Curiosities of Literature,' the most entertaining of his works and that by which he is best known at the present day. This work, the sixth and concluding volume of which was published in 1834, passed through 12 editions in the author's lifetime. Its success was such as to determine D'Israeli to pursue the same path through the literary field, the collection of instructive and amusing gossip relative to literary men and their writings. From this period up to 1812 he appears to have been principally engaged in the collection and preparation of literary materials, the results of his labors appearing in the following works, published between that year and 1822: 'Calamities of Authors'; 'Quarrels of Authors, or Memoirs of Literary Controversy'; and 'Inquiry into the Literary and Political Character of James I.' These were afterward published collectively under the title of 'Miscellanies of Literature.' In 1828 appeared the commencement of his 'Life and Reign of Charles I,' a work completed in 1830. In 1841 appeared his 'Amenities of Literature.' He also wrote several romances. D'Israeli was a man of a pensive and solitary turn of mind and his life was quite that of a literary recluse, spending the greater part of his time in his library, and on terms of friendship with Scott, Byron and Bulwer-Lytton. He abandoned Judaism for Christianity in 1817. A memoir of him, prefixed to a new edition of his 'Curiosities of Literature,' was published by his eldest son, Benjamin Disraeli, afterward Earl of Beaconsfield (q.v.).

DISRUPTION, the name commonly applied in Scotland to the act by which, in 1843, about 500 ministers of the Established Church gave up their livings to vindicate principles which they held to be essential to the purity of the Church and in harmony with its earlier history. A conflict between the civil courts and the Church on the question of lay patronage was its immediate cause. The founders of the Free Church held themselves at liberty to return when the Church which they had left had abandoned its attitude and revindicated its independence of the civil power. See FREE CHURCH; UNITED FREE CHURCH OF SCOTLAND.

DISSECTION, the process of studying the parts or organs of animals or plants by cutting or tearing operations. Practically no complete knowledge of the structure of organized bodies can be obtained in any other way than by complete dissection, and in human anatomy its place in the curriculum is most important. The dissection of human bodies in the study of anatomy has probably taken place as long as we know the history of civilization; although, in certain countries and at certain ages, the practice of human dissection has been forbidden by certain ruling classes,—at one time the Church, another time the state, another time the aristocrat, at another time public opinion. At the present time, however, dissection of the dead body is recognized to be a prime essential to the study of medicine, and throughout all civilized countries it is widely practised.

DISSECTION WOUNDS, wounds made by cutting instruments, during the process of dissection, which differ from ordinary wounds of accidental origin, largely in their greater liability to become infected by pus-producing

bacteria. The human body after death makes an excellent host for a number of these septic organisms, notably the staphylococci and streptococci. It is by the entrance of these usually present organisms into the wounds that this ready infection takes place. Dissection wounds frequently prove fatal by the extension of the infection, with resulting blood poisoning. Great care should be taken by all students of anatomy as well as by undertakers and their assistants in order to avoid accidents of this kind. See BLOOD POISONING; PYÆMIA.

DISSEIZIN, dĭs-sē'zĭn, or **DISSEISIN** (Fr. *dessaisir,* to disseize, deprive of), is the dispossessing one of a freehold estate, or interrupting his seizin. "It is a wrongful putting out of him that is seized of the freehold, not, as in abatement or intrusion, a wrongful entry, where the possession was vacant, but an attack upon him who is in lawful possession, and turning him out. It is an ouster from a freehold in deed as abatement and intrusion are ousters in law." Under the feudal law, when a vassal was admitted to an estate by the ceremony of investiture he was said to be seized of it. The disseizing of him was the turning him out of his fee. This term is synonymous, in modern law, with "adverse possession." There is also what is called in law disseizin by election, when a property holder chooses to consider himself disseized of certain real estate, in order to avail himself of remedies at law applicable only to a disseizee. Equitable disseizin is where a person is wrongfully deprived of the equitable seizin of land, e.g., of the rents and profits. A title by disseizin is a good title against all but the rightful owner.

DISSENTERS, the common name by which in England all Christian denominations, excepting that of the Established Churches, are usually designated, though in acts of Parliament it generally includes only Protestant dissenters, Roman Catholics being referred to under their specific name. The name is not applied to those bodies which dissent from the Established Church in Scotland. The term non-conformists is often used as synonymous with dissenters (see NON-CONFORMISTS). Within recent years the term "Free Churches" has been applied with the same signification to dissenting bodies.

DISSEPIMENT, *in botany,* a division of the ovary; a true dissepiment is formed when the carpels are so united that the edges of each of the contiguous ones by their union form a septum. Each dissepiment is formed by a double wall of two laminæ; when the carpels are placed side by side, true dissepiments must be vertical and not horizontal. A spurious or false dissepiment is formed when the divisions are not joined by the union of the edges of contiguous carpels. They are often horizontal, and are then called phragmata. In the Cruciferæ they are vertical.

DISSOCIATION, *in chemistry,* is the resolution of a substance into other substances, whose molecules have a simpler constitution; but the word is usually applied only to those reversible resolutions in which the secondary products are capable of recombining to form the primitive substance, when the conditions that led to the dissociation are removed or reversed. Dissociation is therefore to be contrasted with "decomposition," for the latter word is used without any implication as to the subsequent behavior of the products into which the primitive substance is resolved.

Dissociation, in the usual sense of the word, is induced directly by the application of heat, and many cases of it have been exhaustively studied. Calcium carbonate may be taken as an example. When this substance is heated in a closed vessel it parts with a portion of its carbon dioxide and becomes reduced to a mixture of calcium oxide, calcium carbonate and free carbon dioxide gas. The decomposition proceeds only up to a certain limit, however, and if (as in "burning" limestone for the production of quicklime) it is desired to reduce the carbonate of calcium entirely to the form of the oxide, it is necessary to provide for the removal of the carbon dioxide gas. If the operation be carried out in a strong closed vessel which contains nothing but calcium carbonate, calcium oxide and carbon dioxide, the decomposition proceeds only until the liberated carbon dioxide attains a definite pressure called the pressure of dissociation, which is always the same for the same temperature, and bears no relation to the quantity of calcium carbonate that is present, provided some quantity of it (no matter how little) still remains. Sir James Hall showed, many years ago, that when calcium carbonate is confined in this way it may even be fused without undergoing decomposition to any considerable extent.

The explanation of these curious facts is, that the carbon dioxide is continually combining with the calcium oxide in certain parts of the vessel with the production of calcium carbonate, while in other parts of the vessel the calcium carbonate is simultaneously dissociating into free calcium oxide and free carbon dioxide. The recombination proceeds with a velocity that is proportional to the density of the free gas, while the dissociation proceeds with a velocity which, for the purpose of illustration at all events, may be regarded as constant. It follows that at low densities of the gas the dissociation will proceed faster than the recombination, the result being that the density of the free gas will increase. But this will also cause the recombination to proceed faster, and finally, when the density of the gas reaches a certain critical value, the recombination and dissociation will proceed with equal velocity and a state of apparent equilibrium will be attained. No further visible decomposition of the carbonate will take place, unless the equilibrium is disturbed by the removal of some of the carbon dioxide (in which case the dissociation will again proceed until the same critical density of the free gas is restored), or by a further increase of temperature (in which case the dissociation will proceed until the density of the gas attains to a new critical value, higher than the first one, and whose value depends upon nothing but the new temperature to which the system has been raised). Reactions such as the one here described thoroughly refute the old doctrines of chemical affinity, which taught that two substances either will or will not combine under given circumstances, according as the chemical "affinities" of the constituent elements would be more or less thoroughly "satisfied" in the possible new compound than they are in the separate substances that might combine to pro-

duce that compound. In the case considered above, combination and decomposition go on simultaneously, and the only question is, which of the two will proceed the faster under given conditions. (See EQUILIBRIUM, CHEMICAL). The quantitative study of the phenomena of dissociation is beset with difficulties, for the extent of the dissociation cannot be ascertained with satisfactory precision in all cases. The products into which the primitive substance is resolved are (by the definition of dissociation) capable of recombining when the conditions that lead to the dissociation are removed. Hence it is by no means easy to determine what proportion of a compound is dissociated under given circumstances. When (as in the case of calcium carbonate) the primitive substance and one dissociation product are solid, and the other dissociation product is gaseous, the extent of the dissociation may be inferred by computing the mass of the free gas, from observations of its volume, pressure and temperature. When the original substance and the products of dissociation are all gaseous, the problem becomes exceedingly difficult, and special means must be devised to fit each special case. In the case of nitrogen tetroxide, N_2O_4, which dissociates into the oxide NO_2, the degree of dissociation may be inferred optically, since N_2O_4 is nearly colorless, while NO_2 has a pronounced brownish-red color. In other cases, the extent of the dissociation may be inferred from observations of the vapor density of the mixture. This method has been used quite successfully in the case of iodine, the vapor density of this element indicating a molecular formula of I_2 at temperatures below 700° C. and I at temperatures above 1,500° C.: while at intermediate temperatures the vapor is a mixture of I and I_2. The dissociation of acetic acid vapor has been studied by the vapor density method and also by observing the specific heat of the mixture at different temperatures, the specific heat being assumed to be greater (on account of the work done in separating the molecules) as the dissociation proceeds than it is before the dissociation begins, or after it is complete.

Certain compounds (such as sodium chloride) appear to be more or less completely dissociated when they are dissolved in water; but the constituents into which they are resolved possess certain distinctive properties that are not manifested by the resolved parts of substances that are dissociated by the action of heat. For this reason it is now usual to distinguish this particular phenomenon by a special name, and the dissociation that occurs in such cases is called "ionization." See ELECTROLYSIS; SOLUTIONS.

DISSOCIATION (*in psychology*). In certain pathological conditions the normal nexus of relations which pervades the consciousness of an individual undergoes a profound alteration, and for all that memory can do, a portion of the experience becomes a sort of enclave, cut off from its associates by boundaries barring out all recollection. Such a portion of experience is said to be dissociated from its companion states. As is indicated in the article PERSONALITY, DISORDERS OF, the nature of a dissociated portion of experience may vary between wide limits. It may be a longitudinal splinter, consisting of the stimuli received by an anæsthetic limb and the volitions expressed thereby, or a stratum in practically undisputed sway of the individual over a given period of time, or as is very frequently the case, it may both coexist and alternate with the primary condition. Furthermore, the primary and secondary conditions may or may not be of equal completeness and of equally sharp outlines. One condition is likely to have a certain degree of insight into the experiences of the other.

The physiological basis and psychological significance of dissociation are alike matters of the greatest interest. It has been asserted by Sidis and other writers that the physiological basis of multiple personality is a change in the conductivity of the interconnections between the neurons. A theory of this sort, however convenient it may be as a means of summarizing the known phenomena, is worthless for explanatory purposes because of our profound ignorance of the processes of nerve-conduction and because of the practical impossibility of studying the anatomy of the intertwining of the dendrites of different neurons, except as mass-phenomena. The psychological significance of dissociation depends on whether the self as the unity of consciousness is or is not something superadded to the system of experiences it unites. If the self is not something beyond the system it states, it follows that the result of a complete dissociation is the formation of two distinct selves, which, as Sidis puts it, share the same body in a manner analogous to the heads of a two-headed monster. On the other hand, if the self is an entity entirely beyond its experiences, it becomes possible and even likely that the duplicity of a dissociated self is fictitious. See PERSONALITY, DISORDERS OF, and consult the bibliography there.

DISSOLUTION, the resolution of any body into the smallest parts by chemical agency. In English politics, the act of dissolving or putting an end to the existence of a Parliament. It differs from a prorogation, which is the continuance of a Parliament from one session to another, and from an adjournment, which is its continuance from one day to another. A dissolution is the civil death of a Parliament and this may be effected in three ways: (1) By the prerogative of the sovereign acting on the advice of his ministers — this advice may be due to various causes, the most important being the loss of support of a majority of the House of Commons. (2) A Parliament may be dissolved or expire by length of time. As the constitution now stands the Parliament must expire or die a natural death at the end of every seventh year, if not sooner dissolved by the royal prerogative; but the custom is to dissolve not later than the sixth year of a Parliament. A situation without precedent in modern times arose after the outbreak of the Great War in 1914, when the life of the Parliament elected in 1910 and which it was intended should expire on 30 Oct. 1915 was extended from time to time by special acts.

The demise of the Crown was formerly followed automatically by a dissolution of Parliament, but since 1867 the life of Parliament remains unaffected by the death of the sovereign.

DISSOLUTION OF CORPORATIONS. See CORPORATIONS, LEGAL.

DISSOLVING VIEWS, paintings upon glass magnified and thrown with great distinctness upon a screen by means of one or two

magic lanterns with strong lenses, and illuminated by the oxyhydrogen light. If one lantern is used the picture is drawn out of focus gradually, and a second substituted, which is brought gradually into focus, thus producing the haze and brilliancy which have gained this sort of exhibition its name. If two lanterns are used, they are placed side by side with their lens tubes slightly convergent, so that the images may be superposed on the screen. An opaque rectangular shutter, capable of revolving vertically upon a pivot fixed midway between the lanterns, is placed before the lenses in such a position that when horizontal, it cuts off one-half of the pencil of light from each lens. When this shutter is made to revolve through a small arc, it shuts off the whole of the pencil of light from lantern No. 1, allowing that from No. 2 to pass unhindered. When the shutter is in this position the image from No. 2 falls on the screen in full distinctness; but when the shutter is made to revolve in the opposite direction, the image from No. 1 will be gradually disclosed, as that of No. 2 becomes concealed.

DISSONANCE (Lat. *dissonantia — dissonare,* to sound harshly). In music, a sound of two or more tones struck together which are at variance with the formation of a common major or minor chord. Thus it is an interval, one or both of whose members must move in a certain way to satisfy the ear — demanding resolution into consonance (q.v.). If the dissonance is minor or major one member only is compelled to move. If augmented or diminished both members must move, toward each other if the interval is diminished, and contrary if augmented. All augmented and diminished intervals, seconds, sevenths and ninths are dissonances. See ACOUSTICS; CHORD.

DISTAFF, the earliest instrument of spinning, a staff, on one end of which the wool or flax was rolled. The spinner held it under the left arm, pressed against the body, or fixed in the waistband of the skirt. The left hand was busy at the tip of the distaff, feeding and distributing the fibre as it was drawn off by the spindle. The spindle, a round stick of wood about 12 inches long with a whorl of clay, a stone, or a potato, at the upper end to give it momentum and steadiness when in rotation, had a slit or notch to which the yarn was caught or fixed. A prepared end of yarn was fixed in the slit and with a deft rolling motion of the spindle with the right hand against the right leg, the spinster threw it from her, while with the left hand, as explained above, the fibre was fed in an increasing length of yarn and thread, twisted, drawn and criss-crossed from bottom to top until the spindle was full. As spinning was a typically feminine employment, "distaff" has come to be used figuratively for woman. The 7th of January is called Saint Distaff's Day, because it marks the return of the women to their usual household duties, after the revels of the Christmas holidays ending with Twelfth Day.

DISTEMPER, a germ disease of the dog family commonly considered as a form of influenza. It affects not only the domestic dog but also foxes, wolves, jackals and the hyena. It generally attacks young dogs — dogs over a year old rarely take it — and only once during life. In large cities the disease may break out at any time; in the small towns and in the country it is more prevalent in hot weather. It is contagious in the highest degree, and is only communicable by infection. In most cases a running from the nose and eyes is one of the first and chief symptoms. This defluxion becomes after some time mucous and purulent, loading the eyes and obstructing the nostrils and whenever the animal is subjected to a draught of air, or excitement of any kind, it has violent fits of coughing combined with vomiting, it soon begins to lose appetite, its flesh begins to waste and it becomes listless and irritable. All the mucous membranes of the body are affected. If the disease be virulent, symptoms of affection of the brain manifest themselves accompanied by convulsions or by convulsive twitchings, resembling Saint Vitus' dance. In such cases the dog is often supposed to be mad, and frequently destroyed in consequence. Pneumonia is not an infrequent supervention of the disorder, and the bowels are more or less affected by diarrhœa and dysenteric discharges. In the first stage of the disease laxatives, emetics, and occasional bleeding are the principal remedies; diarrhœa should be checked by astringents, and to reduce the violence of the fits warm bathing and antispasmodics should be resorted to. Medicine, however, is quite secondary in the treatment of distemper: good nursing and dry comfortable quarters in an even temperature are the essentials. The disease generally runs its course in from two to three weeks. The death rate from it is much larger in the large cities than in small towns and rural districts.

The term distemper is sometimes applied erroneously to influenza in horses, and to epizoötic pleuro-pneumonia in cattle.

Consult Hill, I. W., 'Management and Diseases of the Dog' (new ed., London 1881); Hutyra and Marek, 'Pathology and Therapeutics of Diseases of Animals,' Vol. I (Chicago 1912); Muller and Glass, 'Diseases of the Dog' (3d ed., London 1911).

DISTEMPER (from O. Fr. *destemprer,* Mod. Fr. *détrempe,* Ital. *tempera*), in painting a preparation of chalk mixed in water containing a little glue, white of egg or similar binder. The mixture is tinted by adding dry colors. It is used now chiefly in scene painting, but was employed in the higher departments of art, especially in mural decoration, before the establishment of oil or varnish painting in the 15th century. It is distinguished from fresco, in which the dry colors are mixed with calcined plaster and water and applied to a fresh damp surface of plaster with which they become incorporated.

DISTICH, dis'tĭk, a couplet of verse making complete sense; e.g., Pope's couplet:

> "Be not the first by whom the new are tried,
> Nor yet the last to lay the old aside."

It was much used by Greek and Roman writers in the crystallization of thought. No form is more suitable for maxims or aphorisms. It is also employed in elegiac verse. It was used largely by Goethe and Schiller. The 'Disticha' of Cato Dionysius (q.v.) is a classical textbook on the subject.

DISTILLATION is a special application of the process of evaporation which has for its object the separation of the component parts of a complex or compound substance. The vaporization is done generally by heat with, in some cases, the assistance of a vacuum, and the vapors are collected and condensed generally into a liquid form. When the resulting distillate is a solid and no liquid form has intervened the process is called "sublimation."

The apparatus required in a simple distilling plant is: (1) the still or retort in which the vapors are produced; (2) the condenser in which the vapors are liquefied, and (3) the receiver in which the product or distillate is collected.

The process of distillation is applied to both liquid and solid substances. In the latter case it is called dry distillation when the substance distilled does not liquefy in the operation.

The theory of distillation depends on the fact that a simple substance boils or vaporizes at a certain constant temperature — or, in other words, when its vapor pressure exceeds by the smallest fraction the atmospheric pressure upon it. As a rule the various components of a complex substance will vaporize each at its individual boiling point. By collecting separately the different vapors which come over from the retort at different temperatures the several components are secured. There are some substances which decompose at the normal atmospheric pressure when raised to a temperature high enough to vaporize them. In order to distil such substances it is necessary to reduce the pressure in the retort by producing therein a partial vacuum, which has the effect also of lowering the boiling point. Vaporization of a substance below its boiling point may also be accomplished by passing a current of steam through it.

Another economic use of distillation is the concentration of volatile substances through repeated distillations, as in the case of the rectification of alcohol and the production of glycerine.

Among the articles in common use made by the distillation process are gasoline, kerosene, lubricating oils, paraffin wax, coal-tar color intermediates, aniline oil, alcohol, spirituous liquors, perfumes, essential oils, glycerine, camphor, ether, chloroform, turpentine, sulphuric acid and many others.

When distillation is properly conducted many liquids as for instance, water, can be purified.

Distillation of Water.— Water is never found absolutely pure in nature; it generally contains salts and other mineral substances, organic matter and decomposition products, some volatile and some non-volatile. The water is readily separated from the non-volatile components by distillation. Inasmuch as the volatile constituents are highly evaporative they are received in the very first distillate of the water, so that it is customary to reject this first portion. Experience has taught that pure water is obtained by distilling three-fifths of the entire amount and rejecting the first one-fifth. In some special cases where a water has many volatile impurities which can be detected by its appearance, odor and taste, the distillation might be rendered more difficult as it becomes necessary to add certain chemicals to the water in order to combine with the volatile components and transform them into non-volatile bodies. The purifying of water by means of distillation, or, in other words, the preparation of distilled water, is of much practical value. In the pharmacy, in the chemical laboratory and in many chemical industries distilled water is an indispensable article. The transformation of the salt water of the ocean into a potable water by means of distillation is also of inestimable value. Pure distilled water, however, has often an empyreumatic odor and a repulsive flat taste. According to the most recent medical investigations pure distilled water when constantly used is, on account of its very purity, deleterious to health. It is claimed that this water possesses high solvent properties and also absterges the mucous membrane of the stomach too much. For this reason the odor of the water is improved by thorough aëration or carbonization, and it is made palatable by the addition of pure salt or sugar or any other desired substance. The large ocean steamers have an equipment for producing potable water from sea water. The fundamental elements in this apparatus are a steam generator or evaporator in which the sea water is vaporized by means of superheated steam, which is obtained either from a special boiler or directly from the engine boiler, a condenser combined with an aërator and a refrigerator with which in many cases a filter is combined. In recent times many ships supply themselves with an especially good spring water for drinking, while for cooking, washing and boiler feeding they distil the sea water as it is required. For these latter purposes carbonating and aërating are of course unnecessary. In most cases the evaporator is connected directly with the ship's engine. The sea water which is to be evaporated is taken from the water cooling the condenser, while the steam is obtained from the steam-jacket or an intermediate compartment of the engine. In this way the cylinder is constantly drained and supplied with fresh steam. One form of still utilizes the escaping gases for heating the water so that the entire apparatus is situated in the chimney. In general the distillation of water is very simple, because it is a liquid which has a constant boiling point. More heat in the distillation process simply occasions more rapid evaporation. The escaping steam, unless it is heated in a special apparatus as is done in the case of superheated steam, retains the boiling point temperature until it is cooled.

However, it is different with a mixture of various vaporizable liquids each of which has a different boiling point. According to the predominance of one or the other liquid the mixture will have a varying boiling point. When the vapors passing over at different intervals are separately condensed it is possible to obtain single components from the mixture, provided, of course, that the various components of the mixture differ decidedly in their boiling points. This special method of distillation is called fractional distillation.

The best-known distillation process is the separation of water and alcohol, or, in other words, the concentration or rectifying of alcoholic solutions by means of distillation. This is a special branch of modern industry.

Distillation of Spirits.— The boiling points of water and alcohol differ considerably. At normal atmospheric pressure water boils at 100° C. (212° F.), while alcohol boils at 78.4° C.

(173.5° F.). Consequently, it is evident that the boiling point of a mixture of water and alcohol will range between 173.5° F. and 212° F. In proportion to the predominance of alcohol the boiling point will be lower, and as the alcohol vaporizes the boiling point will rise until, finally, pure water is distilled at 212° F. If a dilute mixture of water and alcohol [the mash in the American distillery usually contains 5 to 10 per cent alcohol by volume (10 to 20 proof)] is distilled in a simple distilling apparatus consisting of a pot or still and a worm, dilute alcohol is always obtained, and the smaller the quantity of alcohol contained in the mixture the greater proportionately will be the amount of alcohol contained in the distillate, as is shown in the following table of Groening:

Percentage of alcohol in the boiling mixture		Boiling point		Percentage of alcohol in the vapor	
Volume	= proof	Centigrade	Fahrenheit	Volume	= proof
1	2	98.75	209.7	13	26
3	6	96.25	205.2	36	72
5	10	95.00	203.0	42	84
7	14	93.75	200.7	50	100
10	20	92.50	198.5	55	110
20	40	87.5	189.5	71	142
30	60	85.0	185.0	78	156
40	80	83.75	182.7	82	164
50	100	82.5	180.5	85	170
60	120	81.25	178.2	87	174
70	140	80.00	176.0	89	178
80	160	79.38	175.2	90.5	181
90	180	78.75	173.7	92	184

If the distillate obtained from a dilute mixture of water and alcohol is redistilled, a distillate containing more alcohol is obtained. Thus in four distillations from a mash having 10 per cent alcohol by volume (20 proof), a raw spirit 80 per cent alcohol by volume (160 proof) is obtained, in which the

first distillate contains 28 per cent alcohol by volume, = 56 proof.
second distillate contains 50 per cent alcohol by volume, = 100 proof.
third distillate contains 70 per cent alcohol by volume, = 140 proof.
fourth distillate contains 80 per cent alcohol by volume, = 160 proof.

Of course, we assume that each time the distillation is carried out completely.

Formerly, it was necessary to repeat the distillation several times, in order to obtain a highly concentrated alcohol. The first weak distillate with less than 20 per cent alcohol by volume was called lutter. It was used for the further concentration of the alcohol. This method of concentrating alcohol was called doubling or rectification, but as this repetition was tedious and consumed much time and fuel, a shortening of the distillation process was eagerly sought for, and with the aid of suitable appliances it has now become possible to accomplish a complex, separatory distillation in one operation.

The following principle is standard for the construction of distillatory apparatus. If the concentrated alcoholic vapors developed at the boiling of the alcohol-water mixture are not cooled at once to the temperature of condensation, but only a few degrees, then a greater part of the less volatile liquid, that is, water, is condensed than of the more volatile alcohol. Through this partial cooling, the remaining vapor accumulates more alcohol. This process is called dephlegmation and denotes a draining of the alcohol, as the older chemists designated the water as a component of spirit by the word "phlegma." Another device by which the alcoholic vapors are enriched is a small closed retort containing a weak distillate through which the hot vapors are passed. The water vapor is condensed, and the alcohol of the distillate vaporizes and joins the vapors from the still. Accordingly, the more recent apparatus in larger distilleries, in which highly concentrated alcohols are manufactured, are equipped with a dephlegmation and rectification appliance, in direct connection with the still, so that it has become possible in the column type of still, with continual operation, to produce, from the fermented mash, a high wine free from fusel, containing 90 to 95 per cent alcohol by volume (180–190 proof).

According to the capacity of the plant, and, especially according to the kind of product, different types of apparatus are used in the distillery; but an enumeration here of these would lead too far, while their description properly belongs under special heads. Therefore only the main types of various distillatory apparatus are mentioned here:

1. Simple stills, with worm condenser heated by direct firing.

2. Simple stills, with closed washwarmers, in which the mash is previously heated by the latent heat of vaporization.

3. Double pot-stills, generally consisting of two superimposed stills. While the mash in the lower still is being deprived of its alcohol, the mash in the upper still is enriched with alcohol and heated by the vapors of the lower mash, until the latter after sufficient concentration is heated to the boiling point. From this time on alcoholic vapors develop in the upper pot which are cooled in a dephlegmator and absorb still more alcohol. The concentrated vapors pass over into the condenser, while the condensed liquid flows back into the upper still. Such apparatus is either heated by direct firing below the lower sill, or by means of steam, which is introduced into the lower still.

4. Two, three or more chamber charge-stills, with or without charging chamber in one apparatus, in which the single compartments are placed one over the other, and the heat from the lower serves to enrich the one above. Steam is used for heating.

All these apparatus, when heated by direct firing, are made either of copper or iron; when heated with steam are made generally of copper, but oftimes of wood, such as heavy

cypress or white oak. These are more suitable for intermittent working, and are used mostly in distilleries which distil rye whisky, etc.

5. Continuous pure still apparatus (on account of their form called column apparatus), which are used mainly in large distilleries, can be regarded as a combination of a large number of small stills, in which the mash, continuously flowing from the upper compartments to the lower, constantly comes in contact with steam flowing in the opposite direction. Through this countercurrent, the rising vapors become more rich in alcohol, through the dephlegmation and rectification taking place in each of the compartments, while the mash flowing downward is constantly deprived of its alcohol until it flows from the lowest chamber as slop, free from alcohol. The concentrated alcoholic vapors, escaping from the uppermost chamber of the column, are then liquefied in a condenser when alcohols of only moderate strength (125 to 150 proof) are to be produced; but, if very pure highly concentrated alcohols are to be manufactured, these vapors pass over into a similarly constructed rectification column, where they meet with the liquids (lutter or phlegma), returning from the dephlegmator or condenser. The vapors take up alcohol from the liquids and pass from the upper chamber of the rectifier into the dephlegmator, in which a continual countercurrent between the condensed liquids constantly takes place.

The advantages of the continual column apparatus in comparison with the simple pot-stills, are, that the mash is more quickly vaporized, that the expense for fuel is diminished and that, as a rule, a more highly concentrated product is obtained. But, on the other hand, they also require more care and attention and skilled operators. Besides, there is a possibility that alcohol might sometimes pass off with the slop. In the simple stills this possibility is considerably reduced, so that it is still advisable for small distilleries to erect good pot-stills, because they manufacture mostly alcoholic liquors with about 50 per cent alcohol by volume (100 proof).

The alcoholic liquid obtained in the distillery with the best modern apparatus contains, besides the highly concentrated alcohol (96 per cent by volume, 192 proof), more or less fusel oil, a mixture of amyl, propyl and isobutyl alcohols. Up to the present time, the following impurities contained in 50 to 95 per cent alcohol have been determined: acetic aldehyde, propylic alcohol, isopropylic alcohol, butylic alcohol, acetic ether, butylic ether, acetal, secondary amylic alcohol, isoamylic alcohol, isobutylic alcohol, furfurol and various amines. In the corn and potato spirits amylic alcohol is in predominance, and therefore it is briefly called fusel oil. Technically, fusel oil is not a uniform substance, but the higher boiling part of the impurities accompanying the alcohol distillation.

Very little is known about the origin of these substances. Their presence might be due to secondary fermentations, which are produced by fission fungi, schizomycetes, but the yeast itself may also have a certain influence, as certain yeast species are capable of producing fermentation products of a definite aroma and taste. For example: *Saccharomyces ellipsoideus* produces a peculiar fruit bouquet. It is well known that aging or decaying yeast furnishes a product with more impurities than a sound and vigorous yeast. The raw material used in the distillery must also be considered. The corn, rye and potato fusel oil differ in composition, so that through experience one is enabled to detect the materials used, by the odor of the raw spirit. The fusel oil of the rye spirit contains, besides amylic alcohol, aromatic œnanthic ether; the molasses spirit contains the ethers of caproic acid, capric acid, caprilic acid, etc., which are very similar to the so-called oil of wine. Finally, the construction of the distillatory apparatus also influences the quality of the product. High pressure and too long a sojourn of the alcoholic vapors in the rectificator or dephlegmator are also said to be detrimental.

As it is necessary for some industries to use pure alcohol, these impurities are generally removed by either of two processes: (1) Filtration of the raw spirit through charcoal; (2) refining, by fractional distillation, or, in some cases, a combination of both.

In the manufacture of brandies, the former method is generally and successfully used, as a trace of impurity gives the brandy its characteristic aroma and taste. Finely powdered charcoal made from soft wood or bark serves as the filtering medium. It is well known that charcoal, by virtue of its absorbing capacity, acts as a decolorizer and deodorant, but in order to effect thorough absorption, the spirit must be diluted to about 40 per cent by volume (80 proof). In smaller plants the filter consists of a vat packed with charcoal. The larger distilleries and refineries use a battery of iron cylinders packed with granular or powdered charcoal. Steam is conducted into the battery until the charcoal is thoroughly saturated; then the spirits flow in, displacing the steam and filling the pores of the charcoal. The larger part of the impurities is absorbed in the lower cylinder, while the remaining impurities are removed during the passage through the remaining cylinders. If a filter is ineffective, it is cut out, the spirit is drawn off, steam is introduced, which forces the distillate into the condenser. This distillate constitutes the so-called "feints." The feints is a dilute spirit, which is milky in appearance on account of the presence of fusel oil in emulsion. After standing, the fusel separates and can then be utilized, while the alcoholic liquid is worked up anew. The emptied filtering cylinder is repacked with charcoal and used as the last filter. The used charcoal is either ignited in a special furnace, or else purified by means of superheated steam.

Refining of Spirits.— In order to produce an entirely fusel-free and highly concentrated alcohol, which is used for blending wine, cognac, etc., as well for scientific and certain technical purposes, the filtered alcohol must undergo a fractional distillation. It is essential that the alcohol, whether filtered or not, be diluted to about 40 to 50 per cent by volume (80 to 100 proof).

The rectificator for refining in general is the same as the distilling apparatus, but, inasmuch as the operation is a fractional one, it is an intermittent one. The columns are equipped with caps, bells or sieves.

Through distillation we receive:

1. The first runnings or fore-shot. This is the first distillate which contains those impurities

of the alcohol which vaporize at a temperature below the boiling point of the latter. Among these impurities acetic aldehyde is especially predominant.

2. Rectified fine spirit, which is divided into several distinct products, of which the first still contains some substances vaporizable at a low temperature and the intermediate products are pure alcohol, while the last portions already contain substances which volatilize at temperatures above the boiling point of alcohol. All of these products are separately collected at different intervals and furnish:

(*a*) Wine spirit, commercially known as Cologne spirit. It contains 96 per cent of alcohol by volume (192 proof).

(*b*) Prime spirit, which is technically absolute alcohol. For medicinal purposes it meets the requirements of the alcohol deodoratum of the United States Pharmacopœia. It contains 94 to 95 per cent alcohol by volume (188 to 190 proof).

(*c*) Common spirit or high wine, commercially called "rectified spirit." It is used for blending wine and cognac for medicinal and all other purposes when a pure, fusel-free, less concentrated alcohol than the foregoing is necessary. It contains about 90 per cent by volume (180 proof).

(*d*) Alcohol of about 88 per cent by volume (176 proof), which can be used for blending brandies as well as for preparing dilute alcohol (97 to 100 proof).

(*e*) Weaker alcohols, which are usually redistilled with the raw spirit.

(*f*) The so-called last runnings or feints, which usually contain some amylic alcohol, are used in various industries, as for example, in the textile industries, on account of their solvent power over fats and oils; in the manufacture of ethereal oil and also in the chemical laboratory.

By means of filtration and fractional distillation, about 85 to 90 per cent of the raw spirit is obtained as rectified spirit, therefore it has been the object of many experiments to improve this yield.

The only successful defuselizing process is that of Traube, by which a sufficiently concentrated potash solution is mixed with the spirit in accordance with its strength and heated to 60° to 70° C. (140° to 158° F.). Two layers are formed, the upper, which is dark-colored and foul-smelling, contains the impurities, and in the lower we find the purified alcohol with the salt solution. After removing the former, the latter is distilled in a rectificator and concentrated; 97 to 98 per cent of the raw spirit is secured by this process.

But after all, filtration through charcoal is the best practical refining process for brandies, while filtration and fractional distillation are best employed for Cologne spirits. In large distilleries the manufacture of Cologne spirit and rectified alcohol directly from the mash is both practically and technically the most advantageous when manufactured in apparatus based on Ilges' system. In ordinary distillation and refining, a deterioration of the material takes place, as the fermentation products of the normal mash are purer than those of the raw spirit. The presence of atmospheric air in the condenser induces the formation of aldehydes and, in the raw spirit, foul-smelling substances. By means of slow evaporization in the rectifier fusel oil is decomposed, while in the new automatic spirit apparatus, it is obtained as fusel oil. But this apparatus is equipped with very effective dephlegmators and rectificators, so that it is an easy matter to precipitate the fusel from the alcoholic vapors and to receive only the purest alcoholic vapor in the condenser. In order to prevent an accumulation of fusel in the ever-returning phlegma, temperature regulators and fusel separators are attached in the latter, so that the phlegma constantly has a uniform temperature and fusel can never be in excess. The advantages of this process are not only the dispensing with rectification and filtration, but also the production of a pure valuable spirit of about 95 per cent alcohol by volume (190 proof), while the valuable and untaxed fusel is obtained as a by-product. In addition, the yield is greater, as the loss caused by rectification is avoided.

Absolute anhydrous pure alcohol cannot be made in this way, nor can it be prepared by repeated distillation, as alcohol is in itself hygroscopic and tenaciously holds on to the last traces (3 to 4 per cent) of water. This last remnant of water can only be removed by very effective dehydrating agents; as for example, freshly burned lime, anhydrous carbonate of potash, anhydrous white copper sulphate, fused calcium chloride and especially metallic sodium. By distillation over any of these substances the water is absorbed and an absolutely anhydrous pure alcohol is produced. This process is, however, only carried out in chemical laboratories and as a precautionary measure this alcohol is stored in small bottles with any of the above substances. This precaution is taken in order to prevent the absorption of moisture by the alcohol. The distillation of alcohol in the United States in the year ended 30 June 1915 was 81,101,064 gallons, of which 42,742,161 gallons were Cologne spirits and 33,854 gallons "high wines."

The distillation of alcohol, as in many other distillatory operations, is merely a mechanical process of purification, as no chemical change takes place, because the distillates have the same chemical composition as the original substance. Distillation is only a mechanical separation of the secondary ingredients from the principal one. Some substances, as for instance, glycerine, when distilled in presence of atmospheric air, will decompose. In such cases the distillation is done in a partial vacuum. By means of an air-pump the pressure of the air is reduced until the boiling point is lowered to that degree at which the distillation can take place without decomposition. It is well known that matter will boil at a lower temperature, when the pressure is decreased; and that decomposition is less liable to occur. Again, other substances cannot be distilled in the presence of much oxygen, so that carbonic acid, hydrogen, or other gases are forced into the still. These gases pass over with the vapors of distillation. This process is called the distillation in an atmosphere of an indifferent gas.

By far the most extensive of the distillation industries is that of petroleum, not to mention the many individual industries distilling petroleum products. The world's annual produc-

tion of crude petroleum is about 20,000,000,000 gallons, and except for a relatively small percentage used direct as fuel, practically the whole output passes twice through the still and condenser before it is fitted for use. In the United States alone nearly 14,000,000,000 gallons is thus twice distilled annually. In Scotland some 70,000,000 gallons of crude oil are obtained annually from the oil shales by dry distillation.

The primary distillation of crude petroleum is commonly called refining. The oil is separated by the first distillation into (1) benzine or naphtha, coming over up to a temperature of 300° F.; (2) kerosene, coming over above 300° and up to 570°; and (3) residuum, which includes lubricating oils, paraffin wax, vaseline, and pitch or asphalt, according to circumstances. These are again separated before marketing. From the naphtha is obtained gasoline, up to 160°; benzine between 160° and 250°; and heavy benzine or «turpentine substitute» between 250° and 300°.

In the kerosene distillation, gas oil is first separated: it is used to enrich coal gas. After the principal part of the kerosene is distilled, the remainder is paraffin oil, also a burning oil, but with a higher flash-point. The lubricating oils are obtained by distilling the residuum in a vacuum with superheated steam. There are three degrees of these oils: light, medium and heavy. They are caught in three separate dephlegmating condensing tubes through which the vapors are made to pass, the heaviest oil condensing in the tube nearest the still, and the lightest traveling to the furthest tube before it condenses. Vaseline is obtained by carefully distilling certain kinds of crude petroleum in a vacuum still. Other products obtained from petroleum by distillation are paraffin wax, ceresine or earth wax, and a variety of asphalt, besides pitch and coke.

The distillation of coal-tar is detailed under the title Coal-Tar Products.

The distillation process is employed in candle-making for the purification of the fatty acids from which the candles are made. The operation takes place in a large copper still heated by a direct fire to about 500° F. Melted fats (after saponification) are run into the still as the operation progresses. Steam, superheated to from 500° to 700°, is blown through the liquid mass, and the fats distilled over into copper coils cooled by running water. The palmitic acid comes over first, followed by the stearic and oleic acids as the heat increases. These three fats constitute about 80 to 95 per cent of the whole. The distillate is allowed to cool very slowly for 10 or 12 hours during which time the stearic and palmitic acids crystallize in large crystals, with the oleic acid entangled among them in a liquid form. The «cakes» thus obtained are put cold under hydraulic pressure of 250 atmospheres, and then again in the «hot» press (temperature, 140°) to remove the oleic acid. The candle fats are then ready for molding.

Another important application of the distillation process is in the recovery of glycerol (pure glycerine) following the saponification of fats in making soaps and candles. The glycerol remains in a watery solution after the fatty acids are separated out, and is first concentrated by evaporation to about an 80 per cent solution. This crude glycerol is subjected in a still, in a vacuum of 28 inches, to blowing with dry steam at 300°. The first distillate contains volatile organic acids. These are neutralized with soda, and the product again distilled in vacuum. After concentration and reconcentration it is again distilled, and once more concentrated, this time to the standard specific gravity of 1.262. It is then ready for market as «dynamite glycerol,» extensively used in making high explosives. For medical and food purposes the glycerol is again distilled and clarified.

The manufacture of natural perfumes and essential oils depends largely upon the distillation process. In preparing perfumes, the flowers are heated with water in stills, and the steam coming over carries the perfume oil with it. In some instances the perfume oil is dissolved out from the flowers by a volatile solvent like alcohol, ether or benzol, and the solvent then distilled off, leaving the heavier perfume oil. With the essential oils, extraction by pressure sometimes precedes the distillation, as with lemon and orange peel, and other citrus oils. The preliminary treatment with solvents is also used in gaining essential oils, as with celery (from the seed), cinnamon, cloves, ginger, etc. The method of extraction by a solvent (bisulphide of carbon, or petroleum spirit), and subsequent distillation, is finding favor in a much wider field than formerly. It has been found profitable by this process to extract the oils from the oil-cake residue of the cotton-seed and linseed oil presses, and it is used also at first hand in gaining the oils from poppy seed, rape seed, castor oil beans, copra, palm kernels, pumpkin seeds, grape seeds, and the like. It has also been successfully used to extract olive oil from the residuum of the olive oil presses. The solvent is used over and over again in a continuous still which is almost automatic, requiring a minimum of attention, and in the case of the recovery of oil from oil-cake, the oil-meal residue is as greedily eaten by cattle as the original oil-cake. This process has made it possible to recover much oil which has heretofore been sacrificed if not altogether wasted.

Another important distillation process is the so-called dry distillation, in which organic substances are decomposed into solid, fluid, and gaseous products by means of high temperatures and with the exclusion of air. As a rule these products, called empyreumatic, are formed simultaneously, but are separately collected and treated. An example of dry distillation, which is also called destructive distillation, as it is accompanied by chemical changes, is the distillation of coal for the manufacture of illuminating gas. Ammonia-water (in the raw condition, tar-water, which contains cyanides and sulphocyanides in connection with ammonia), semi-fluid, viscous, oily, and very valuable products, as, for example, tar-oil, which is extensively used in the manufacture of aniline colors, antiseptics, and medicinal preparations, are obtained as by-products, while coke is the residue of the coal distillation.

The distillation of wood is conducted in the case of resinous woods by steam, and with hard woods by dry distillation. The former is preferred in the manufacture of turpentine, because it avoids drawing the tar from the wood. The retort is filled with pine wood chips, and steam is turned in with a rush, so as to heat the whole as quickly as possible, the pressure

not to exceed ten pounds to the square inch. The contents of the retort are agitated by a mechanical stirrer, and the process continues as long as a paying quantity of oil comes over. With the turpentine is a small proportion of ethers and aldehydes, and some resinous matters. The turpentine is redistilled for the market, leaving as a residue, resin oil. The resin (colophony) remaining in the retort is distilled in an iron still by the dry process and yields resin spirit and resin oil, and resin tallow. The resin oils are rectified by the distillation process, followed by a chemical process. In the distillation of hard woods without steam, the products are wood vinegar (pyroligneous liquor) 42 to 45 per cent — equal to acetic acid 7 to 9 per cent; tar 8 to 9 per cent; and charcoal 22 to 26 per cent. Further distillation of these primary products results in the gaining of a great number of substances from the tar, particularly paraffins, phenols and esters such as paracresol, guaiacol (from beechwood tar), kreosol, pyrogallic esters, fatty acids and their esters, light tar oils and heavy tar oils, and pitch. From the pyroligneous liquor is obtained acetic acid, up to 10 per cent; wood alcohol up to two per cent; and small quantities of propionic, butyric, formic and other acids, methyl acetate, allyl alcohol, furfurol, phenols, amines, ketones, etc. The commercial manufacture of wood alcohol, however, is accomplished by treating wood with concentrated sulphuric acid, thus transforming its cellulose to a form of sugar which is then fermented and the mash distilled.

Resins of all sorts are distilled before being of value for varnish making. The process used is generally by superheated steam under pressure.

Ether is obtained by distilling sulphuric acid and alcohol together in a steam-heated lead-lined retort, and passing the vapors through a solution of sodium carbonate, or milk of lime, to remove all traces of acid. A second distillation removes the alcohol, and the ether is rectified in a columnar still.

Besides these above-mentioned industries, many others are also based on the distillatory process.

A special branch of distillation is that in which a solid is vaporized and by condensation directly passes from the gaseous to the original solid usually in a crystalline form. This process is called sublimation, and is mostly used to purify volatile solids, as for example, sal-ammoniac (chloride of ammonia), benzoic acid, camphor and indigo. The most interesting fact in sublimation is that the solid does not pass through a liquid state, but at once to the gaseous form. The reverse process also takes place in like manner, namely, the condensation from the gaseous state back directly to the solid condition.

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DISTILLED LIQUORS, or **SPIRITUOUS LIQUORS,** the alcoholic beverages obtained by distillation as distinguished from the fermented liquors, wine, beer and cider, etc. The highly concentrated alcoholic liquids used in technics, medicine, pharmacy, etc., are called alcoholic spirits. In the distilled liquor beverage, alcohol is always the main ingredient and the varying aroma and flavor, due to the origin and the method of production, influence its commercial value. On the other hand, spirits are judged according to their concentration and any secondary ingredients and aromatic substances depreciate their value. Hence in the manufacture of spirits everything that is not alcohol is eliminated.

The distilled liquors best known in the United States are:

Whisky — made from malt and unmalted cereals.

Brandy — made from grape wine.

Gin — made from malt with rye or barley.

Rum — made from molasses.

Cordials — compounded from aromatic tinctures and sugar syrups.

In Germany, *kornbranntwein,* made from malt and rye or corn, and *schnapps,* made by diluting rectified alcohol and adding flavors and sugar, are distilled liquors in common use. In Austria *slivovitz* is distilled from the fermented juice of the prune-plum. In the East the liquor *arrack* is distilled from palm wine, with rice and molasses. In Russia the popular liquor *vodka* is made from rye.

In the United States the concentration of alcohol in liquors and spirits is determined according to proof-degrees. The regulations of the United States Internal Revenue Office say that "proof spirit shall be held to be that alcoholic liquor which contains one half its volume of alcohol of a specific gravity of 0.7939 at 60° F." Therefore each proof-degree is equivalent to a volume measuring one-half of 1 per cent.

If 100 gallons of liquor contain 48 gallons of absolute alcohol, it is 2 x 48 or 96 proof, and a spirit containing 92 gallons of alcohol per 100 gallons, is one with 92 x 2 or 184 proof. The revenue standard is a liquor with 50 volumes per cent (100 proof) of alcohol. "Over" and "under" proof are not officially recognized in the United States, although we find these distinctions given in older books.

The raw materials used in the preparation of alcoholic liquors and spirits are:

1. *Alcoholic liquids,* as wine and its waste and by-products (wine-yeast, grape-cakes), the waste and by-products of the brewing industry, in which the spirit is obtained solely by distillation. The product of the wine distillation is used almost exclusively for cognac and brandy, which are especially manufactured in California and Ohio.

2. *Sugary substances,* as the extract of the sugar-beet, sugarcane, mainly molasses and also of sweet fruits (cherries, plums, melons, etc.), the sweet potato, the juice of the sugar palm, the carob bean (Saint John's bread), etc. The sugar must be converted into alcohol by fermentation prior to distillation.

3. *Starchy substances,* which comprise the various cereals (barley, barley-malt, corn, rye, wheat, oats, rice, buckwheat, etc.), and also potatoes. Corn, barley, barley-malt, rye, oats and wheat are those mostly used in the United States. Before the alcohol can be obtained, the starch must be transformed into fermentable sugar, which in turn is fermented, to produce the alcohol previous to distillation.

4. *Fibrous substances,* in which the cellulose is converted into fermentable sugar. The further treatment is the same as detailed above (No. 3). Concentrated mineral acids acting under pressure on cellulose, will cause the formation of fermentable sugar, and since such fibrous substances (peat, sawdust, etc.) are inexpensive, many experiments have been made to obtain a practical method for producing alcohol from such materials. Many such methods have been patented. The manufacture of alcohol from fibre stuff has of late years assumed greater importance and such spirits can now be successfully obtained in large quantities.

5. *Mineral spirit* is of theoretical interest, although it can be prepared in the chemical laboratory. If ethylene (C_2H_4) is conducted into sulphuric acid, ethylsulphuric acid ($C_2H_5HSO_4$) is formed, which if diluted with water will split up into sulphuric acid and alcohol. Ethylene is a gas and is an ingredient of illuminating gas made from coal. It is also easily produced from acetylene (C_2H_2) by nascent hydrogen, according to the formula $C_2H_2 + H_2 = C_2H_4$.

In accordance with the importance of these various kinds of raw material consumed in the large United States distilleries, we will first of all discuss the manufactures of liquors and spirits from starchy substances.

These raw materials are treated, as in the brewing industry, with malt (mostly barley malt, sometimes also rye and wheat malt) in such a way that the diastase of the malt converts the starch into dextrin. and sugar. But a distiller's malt differs in its properties from a brewer's malt. While the latter must impart its aroma and taste to the beer and only exert its diastatic power in a moderate degree, some of the starch remaining unchanged in the liquor, the former must be characterized by a maximum of diastatic power, to convert all the starch into fermentable sugar. Consequently the distiller prefers a malt from a small-kerneled barley, which has been killed at low temperatures. The diastatic power is weakened by high temperatures and hence some distillers, who operate a malting plant in connection with the distillery, used only green malt, or at most, air-dried malt. The German distillers universally use green malt. In contradistinction to the brewer, the distiller prefers a malt made from a barley rich in nitrogenous matter, as this latter furnishes material for the formation of diastase and for the nourishment of the yeast. The malt used by distillers is that known as "long malt" (malted for 20 days) as distinguished from "short malt" (malted for 7 days), used by the brewers. In making the long malt the grain is steeped until it has absorbed 40 to 45 per cent of water. It is then spread upon the malting floor for 20 days and kept at a temperature not above 63°. The development of mold or other bacteria is avoided by previously soaking the grain in diluted milk of lime. While the long malting causes a loss of starch, the gain of diastase far overbalances it. In mashing, the largest possible amount of starch must be converted into fermentable sugar (maltose) in order to obtain the highest yield of alcohol in the distillation. Under the most favorable conditions 96 per cent of the starch in the mash material can be converted into maltose (the remaining 4 per cent is changed into dextrin), while in ordinary practice only about 80 to 81 per cent maltose is obtained and the remainder is dextrin. After the maltose is decomposed into carbonic acid and alcohol, the dextrin is gradually converted by the diastase into maltose and then fermented. This can only be accomplished with vigorous yeast and proper treatment in the fermenting rooms. On account of this "after-effect" the diastase must be carefully protected from destruction by avoiding high mashing-off temperatures and the formation of an excess of lactic acid and particularly butyric acid, produced by certain bacteria at a temperature of 104° to 122° F.

The mashing process varies according to the kind of product desired, the capacity of equipment (large, or small, or very small, the latter requiring hand power for mashing in place of machinery), the amount and quality of the raw material and, oftentimes, on the fancy of the customers. Inasmuch as whisky is the main product of United States distilleries, we will discuss its preparation first of all.

The word "whisky" is of Celtic origin, for it apparently is an abbreviation of the word "usquebaugh" or "uisgebeatha," which corresponds to the Latin *aqua vitæ* (water of life), According to historical research the word *aqua vitæ* is a corruption, because the original wording for distilled spirit was *aqua de vite* (water from the grape vine). In mediæval times the monks changed this earlier form to the one now in general use.

Although the same term is used in America, Ireland and Scotland, the product is different. The Irish and Scotch distilleries use almost exclusively kilned malt (only rarely, other cereals), while the American distilleries have an entirely different equipment and also their own characteristic development.

For the manufacture of whisky, especially corn and rye, sometimes also bran, wheat and kilned malt (6 to 15 per cent) are used. The best-known brands are:

Bourbon whisky, in the manufacture of which corn is the main ingredient, with barley malt, or wheat malt and rye. According to the quality of the Bourbon, the materials vary as follows:

Ordinary Bourbon whisky is made from a mixture of 10 per cent malt; 10 per cent rye; and 80 per cent corn; Medium Bourbon from 12 per cent malt; 18 to 22 per cent rye, and 66 to 70 per cent corn; Good Bourbon from 15 per cent malt; 35 per cent rye; and 50 per cent corn.

Rye whisky when manufactured as a first-class article is made from 10 to 15 per cent kilned barley malt, 70 per cent rye and the remainder rye-malt. Some distilleries replace a part of the rye by oats or barley.

Half rye whisky is similarly made as the above, except that for one-half of the rye, corn is substituted.

Malt whisky, in which malt predominates.
Wheat whisky and
Oat whisky are made in the same way as rye and half rye whisky, except that wheat or oats is used in place of rye.

We must remark here, that the above appellations are in exact use only by the distiller, and that in commerce similar names are given to so-called compound whiskies. Under this term are meant those products which are produced from pure whisky, either by dilution with water and rectified spirits, or by a mixture of several kinds, or by still further blending and mixing. In some cases, other liquors, as for example, cognac, or rum, or even essences, are added to the pure whiskies. This compounding is done in accordance with the requirements of local trade, or the special tastes and desires of the customers. The character of the natural product is dependent upon the materials and the methods of mashing and distilling.

According to the method chosen for mashing we distinguish a «sweet mash» and a «sour mash» whisky. The latter is characterized by a delicate, slightly sour taste and a fine ethereal aroma.

Mashing for Whisky.— The material is ground separately, weighed in hoppers, and placed under a revenue-lock. In the smaller distilleries the corn is mixed with 20 to 25 gallons of hot water to the bushel, and kept boiling by means of steam until the starch becomes gelatinous. In larger distilleries the corn is gelatinized in high pressure cookers, under a pressure of 60 to 80 pounds. In either case the cooked corn is cooled down to about 150° F. In the high pressure cookers this reduction in the temperature is accomplished by a vacuum pump. In the smaller plants, malt, rye or other cereals are added to the corn mash cooled to 164 to 166° F., so that the entire mash has a temperature of about 156° to 160° F. In the larger distilleries the specially prepared rye or malt mash is drawn into the cooker by means of a vacuum pump. Here it is thoroughly mixed so that the final temperature is about 150° to 155° F. In order to obtain complete saccharification, mashing is done at this temperature for 30 minutes or longer, and then the mash together with the grain is run into a collecting tub, from which it is pumped through a cooling system into the fermenters. The cooling system usually consists of a worm of a half inch copper pipe, which is encased in an iron water pipe. The mash flows through the copper pipe in one direction, while the current of water flows around the pipe in the opposite direction. It is always desirable to cool the mash to 64° F., but on account of the higher temperature of the cooling water, it is usually possible to cool the mash only to 66° to 68° F. At any rate its temperature should never be above 70° F. The concentration of the mash varies proportionately with the amount of material, and is usually about 18 to 25 per cent (seldom more).

While the mash is pumped into the fermenters, as much water or slop of the same temperature as the mash is added to the latter until its concentration is about 11 to 13 per cent.

The above-described method is used for sweet mash whisky, while for sour mash, slop is always used for mashing in place of water. The slop has not only acquired a definite lactic acid content through the fermentation process, and certain peculiar and flavoring substances from the yeast, but also contains certain conversion products, formed by heating the grains in the distiller. Hence by the use of this slop, the whisky receives certain characteristics which have made it popular. In smaller distilleries, oak vats, so-called bushel tubs, are used, into which boiling slop is poured, and corn in grits-form is doughed in under constant agitation with the hand (hence the name, hand-made sour mash). The malt and rye are added at 165° F. In medium-sized plants a large quantity of corn is doughed in in a similar manner in special mash tuns, and after the mash becomes somewhat thinner, due to the saccharification, it is pumped into hopper-like copper vessels. After the mashing off, the mash remains in the bushel tubs of the smaller distillery or in the vats of the larger plants for 20 to 24 hours for acidification. After this time, the mash is still of a somewhat solid consistency, so that it is separated in drums by means of a disintegrator. After cooling to the pitching temperature (64° to 68° F.), the mash is diluted with slop, to about 17 to 19 per cent. In some distilleries the concentration is lower.

The mashing process is different in very large distilleries, which have commodious mechanical appliances, and are prepared to mash vast amounts of material. It is customary to bring the corn mashed with water to the boiling point by means of steam, and then to heat the corn to 300° to 310° F. (60 to 80 pounds pressure). The corn is kept at this temperature for 10 minutes in order to gelatinize the starch. The surplus steam is blown off, and the corn mash is cooled to about 164° F. At the same time, malt, rye, oats or barley is mashed in with water in a special mash tank, which is supplied with a simple agitator and a double copper attemperator coil. After both mashes are united, the temperature is about 130° F., which is the temperature at which the largest possible amount of sugar is formed.

This mashing method is used in the large factories both for the manufacture of whisky, high wines and spirits. The various brands of whisky are then made by the use of different materials of varying properties. These large distilleries also use slop in place of water when making a sour mash whisky. In order to obtain a higher degree of acidification, more lactic acid is allowed to form in the malt mash. In comparing the large distilleries with the smaller ones, we find that while the latter can pay more attention to the characteristic properties of the whiskies, especially sour mash and fancy goods, the former does its practical work more technically and also obtains much higher yields. The manufacture of concentrated alcoholic spirits is only profitable when all the modern mechanical appliances are at hand, so that, owing to the constant decrease in the price of alcoholic spirits, the number of smaller plants is becoming less.

Fermentation of the Mash.— The sugary mash is fermented in the fermenters by means of yeast. A very large number of different races of yeasts exist, each of which produces an alcoholic liquor differing in flavor from the others. They fall naturally into two classes: (1) Culture yeasts, and (2) wild yeasts. The former have been cultivated for long periods

of time by the fermentation industries, and have acquired characteristics which render them of great value for the production of alcohol and alcoholic liquors. The yeast used in fermenting whisky mashes belongs to the genus *saccharomyces cerevisiæ*. The yeast used in fermenting wines from which brandy is distilled belongs to the genus *saccharomyces ellipsoideus*.

The distiller's yeast must be able to flourish vigorously in solutions with a high percentage of acid, and also when the alcohol content of the mash becomes considerable. In England, common ale yeast is usually added; in France and Belgium either top-fermenting or compressed yeast, which is also used by bakers, is generally added. In the scientifically operated German distilleries, the inventions and discoveries of modern times are successfully used, as for instance, a pure yeast culture of a distiller's yeast is made according to Hansen's method, just as a pure beer yeast is cultivated in many United States breweries according to the same method. In the United States distilleries a yeast obtained by spontaneous fermentation is generally used. Here Delbrueck's teachings in regard to natural pure culture are of importance. Experience teaches that when several yeast species are present, a certain one can be developed under certain conditions of nourishment, because a mash of definite concentration and proportion of fermentable to non-fermentable substances, made from definite materials, consequently containing definite percentages of albuminous and mineral substances, will vigorously develop at a definite temperature and acidity only one species of yeast and will suppress the rest. By maintaining the same conditions on a larger scale, that is, by using a greater amount of mash, the yeast thus developed can be further propagated. But in spite of the utmost care, natural pure culture is oftentimes defective, because the standard requirements are not rigorously observed. It may also happen that among the air yeasts which are developed for spontaneous fermentation, there is no species which will flourish under these requirements. Consequently, it would be advisable to introduce pure cultures, made from one indivdual cell, according to Hansen's method. Then the distiller would not be dependent on chance; and, of course, a pure yeast developed according to Hansen's method, would have to be cared for according to the principles of natural pure culture, as, otherwise, an infection with undesirable yeasts, mycoderma or fission fungi would gradually destroy the pure yeast.

In the United States distilleries the yeast is developed as follows:

A clear malt mash is made from ground malt and pure water, generally distilled water. The water is boiled with hops, one ounce of hops per gallon of water, cooled to 170° F. and added to the ground malt, whereupon saccharification will take place. As soon as the conversion is completed, a clear mash is drawn either by filtration or extraction, which is then concentrated to 18 to 30 per cent Balling and cooled to 70° to 72° F. Air is forced into the mash in small copper vessels, so that after 24 to 48 hours the yeasts of the air will cause fermentation. This mash in the copper jugs is the so-called stock-yeast and is cultivated as needed. In case the yeast thus obtained is not satisfactory, the process is repeated. Most distillers constantly have a supply of this jug-yeast on hand and regenerate it by adding a portion of it to the above described, hopped, clear malt mash. This original yeast is poured into sterilized copper jugs and stored in an ice box or other suitably cool place.

This yeast is propagated for use in this way: The distiller first heats a rye and malt mash very rapidly to 130° F., when the maximum saccharifying action takes place, and keeps it at this temperature a short time. Then the heat is raised quickly to 144° when the maximum liquefaction of starch takes place. Finally the heat is raised to 150° to 154°, which destroys harmful bacteria, but does not injure diastase if plenty of sugar is present in the solution. The temperature most favorable to the action of distiller's yeast is between 75° and 81°. A slightly acid wort favors the development of distiller's yeasts, and checks the brewery yeasts and bacteria.

Souring is accomplished through a special mash at 148° to 158°, from kilned malt to which is added unmalted wheat, corn or rye. This mash at 122° is inoculated with a pure culture of lactic acid bacteria. When about 1 per cent of lactic acid has been formed, the temperature is raised to 165° and the lactic bacteria killed. The mash is then cooled to 80° and pitched with distillery yeast, and then slowly cooled to 60°. As fermentation proceeds the temperature rises, but it must be kept below 85°. This yeast mash is ripe in 10 to 14 hours after pitching, and is then run into the sweet wort at 68°. The period of greatest fermentation is after 24 hours, and continues 12 to 18 hours — during which the temperature is kept below 85° to prevent loss of alcohol through evaporation. The duration of fermentation is for spirits and sweet-mash whiskies, 72 hours, while for sour-mash whisky it requires 76 hours.

Sometimes abnormal conditions arise, among which is the so-called "foaming fermentation" that is an exceptionally stormy fermentation, in which losses of alcohol occur, due to the flowing over of the mash over the edge or rim of the fermenter. This is a result of various defects, and is either partly due to the materials, or the yeast, or may be occasioned by irregularities in the operation, or even by other causes. It would lead too far to enumerate them here, but much has been written on this subject by experts.

The fermented mash, called the sour mash, is now pumped into the distilling apparatus, where it is distilled as is fully described in the article DISTILLATION. It is customary to distil the whiskies to 102–105 proof and spirits to 188–190 proof. In small distilleries an ordinary pot-still is used for whiskies and a liquor of about 70 proof is obtained, which is concentrated to 101–102 proof in a doubler. A doubler consists of a copper cylinder having a wide outlet pipe, from which the vapors enter the condenser. In the small distilleries, the heating is accomplished by direct firing, by which a peculiar, characteristic taste, which is appreciated by the consumers, is engendered. Such whisky is called "Fire Copper Bourbon Whisky."

When oats, barley or wheat are used in the manufacture of certain whiskies, they are worked up in the same manner as rye in the above-described mash.

Potatoes are not mashed in the United States,

although they are commonly used in Germany. They contain only 18 to 20 per cent of starch, while the cereals contain 60 and more per cent of starch. Instead of mashing the ground, rasped or chipped potatoes in open mash-tubs, as was formerly done and is even done to-day in small plants, they are now first steamed under a pressure of two to three atmospheres, whereby the starch is put in condition to be easily acted upon by the diastase. After the steaming the potato mass is cooled to 55 to 60° C. (131 to 140° F.), which is the best saccharification temperature. Then this mass is mixed with malt, generally green malt, either in the cooker or in the mash-tub, and saccharified. It is customary in Germany to make a thick mash of 22 per cent (Balling), sometimes even of 26 to 28 per cent. The fermentation is accomplished by the addition of a cultivated pure culture yeast. The distilling process is similar to our method. In Germany less brandy but more highly concentrated alcohol for industrial purposes is made.

In all those cases, in which a mealy substance is utilized, the thin slop remains after the distillation, which contains all the ingredients of the corn and yeast mash. Besides the skins and husks, we find albumen, unfermented sugar, lactic acid, acetic acid, glycerine, mineral substances, etc. This wet slop was mainly used as feed for cattle, so that formerly every distiller also had a herd of cattle. It is claimed that an animal's health will suffer if slops are copiously fed, so that on this account, and especially in order to dispense with some of the labor caused by the maintenance of the cattle, the slop was dried. By thorough drying, which can be done immediately after the distillation, spoiling is prevented and a constantly durable and valuable article of commerce, which need never be given away below its full value, is obtained. The drying of slop is accomplished in several operations: (1) Settling of the insoluble substances; (2) Pressing out; (3) Drying in cylindrical driers.

There is also apparatus in which the slop is concentrated by means of steam, pressed and finally dried.

The feeding value of wet and dry slop can readily be seen from these analytical data, obtained by the Industrial Chemical Institute of Milwaukee in an analysis of slop in either condition. The mash material was composed of 80 per cent corn, 10 per cent rye, and 10 per cent malt.

ANALYSIS OF THE SLOP

CONDITION	Water	Proteids	Nitrogen-free carbohydrates	Fat	Cellulose	Ash
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Wet	91.2	2.34	3.63	1.22	0.88	0.74
Dry	11.94	23.43	36.35	12.22	8.78	7.28

Preparation of Alcohol by Fungi.— This process, which is used in Japan in the manufacture of saké, was changed for other cereals by Takamine, a Japanese, and was introduced by him in 1893–94 in the Manhattan distillery in Peoria, Ill. But this process has not been extensively used, so that now it is almost forgotten, although it aroused considerable interest at one time. In this process the spores of a certain fungus, as for instance *aspergillus oryzæ* are exposed in hothouse-like compartments to uniformly moist air of 77° F. on steamed, coarse wheat bran. The spores rapidly develop to an exuberant white mold whose mycelium forms numerous spore-bearing threads which grow into the nutrient medium. A considerable portion of the nutrient medium is consumed and a decided rise in temperature is noticeable. According to the temperature, the formation of mold is finished in about 36 to 48 hours, whereupon the mass with the fungi is mixed with an equal amount of wheat bran and extracted in water, whereby the Koji-extract is obtained. This is added at 140° F. to corn, cooked in the customary manner, whereupon complete conversion is effected as with diastase The mash thus obtained, which has a concentration of about 15 per cent Balling, is fermented in four days by means of a fungus, called *takamoto,* propagated in a similar manner to the Koji fungus. It is claimed that the yield in this process is 11 to 12 per cent higher than in the process now in vogue. In some large corn distilleries in Europe the fungus *amylomyces Rouxii* is used instead of malt to furnish the diastase. A sterilized corn mash is inoculated with a very small quantity of the fungus and filtered air is blown through the mash for 20 hours. The fungus spreads with great rapidity, converting the starch into sugar. Yeast is added during the action of the fungus-diastase, and ferments the sugar as it is formed, the two agents acting together. One gram (15 grains) of the fungus culture is sufficient to saccharify 25 tons of corn, saving three tons of malt besides the one ton of starch consumed by the malting. This mash being sterilized is worked in closed vessels so that harmful bacteria do not gain an entrance.

In the Belgian distilleries Effront's system is successfully used to prevent disturbances in the operation of the plant caused by infection. The main principle in this system is that the highly antiseptic hydrofluoric acid or mono- or bi-fluoride of ammonia is added to the mash, taking the place of lactic acid. Hydrofluoric acid, in small proportions, is poisonous to the harmful bacteria, while not affecting distillery yeasts up to 2/10 of one per cent.

The Control of the Distillery.— It is self-evident that the control in the distillery is of prime importance in a rationally operated plant, for which reason also the large distilleries, which have well-equipped laboratories, work advantageously, while on the other hand, the small distillers constantly suffer losses. The control is properly carried out when regular analyses are made of the raw materials of the supplementary articles, namely the yeast, the mash before and after fermentation, the slop, the water and also the air in the mashing and fermentation cellar. (The Kentucky distilleries use a pure, hard water, rich in lime.) It hap-

pens in too many cases that the control is not properly carried out, which is, of course, a loss to the distiller, although at present the small distiller is enabled to have the control carried out by a special laboratory (Industrial Chemical Institute of Milwaukee). When the control is properly exercised, the yield will be increased. Inasmuch as theoretically one pound of starch produces 0.5678 lb. of alcohol, then, according to Hantke, the highest possible yield of a distiller's bushel (which is always figured at 56 lbs. whether the material actually weighs that much or not) with

60 per cent starch in the material will be 5.76 gal. proof alcohol.
61 per cent starch in the material will be 5.86 gal. proof alcohol.
62 per cent starch in the material will be 5.95 gal. proof alcohol.
63 per cent starch in the material will be 6.05 gal. proof alcohol.

But in practice the yields obtained from one bushel of grain (56 lbs.) are as follows:

90 per cent corn + 10 per cent malt, about 4.7 gal. proof, seldom 4.9 gal. proof.
55 per cent corn + 35 per cent rye + 10 per cent malt, about 4.25 gal. proof.
65 per cent rye + 15 per cent malt + 20 per cent of rye, malt or oats, or barley — about 4.0 gal. proof.

Scotch Whisky is made in a pot-still. Its peculiar smoky flavor is due to the use of a peat fire in kiln-drying the malt. It is made from barley malt and corn, the latter often imported from the United States. But in some cases rye and oats are also used.

Irish Whisky is a pot-still liquor made from 30 to 50 per cent of barley malt, with rye, barley, oats or wheat or a mixture of them. The malt is not peat dried and the liquor has a delicate bouquet and a high alcohol content.

Brandy of the finest sort (Cognac) is distilled from clear white grape wine which has been aged for at least a year. It is golden yellow in color and has a content of from 45 to 55 per cent alcohol. Ordinary brandies are distilled from freshly made and fermented grape wines in two distillations. The first yields liquor of 25 to 30 per cent alcohol; the second brings up the percentage to about 65 per cent. To remove the fusel oil, fractional distillation is resorted to. After distillation the brandy is placed in oak casks which previously have been well scalded with boiling water, or preferably, with steam. To acquire a desirable degree of smoothness and flavor, the brandy is stored at least four or five years. Longer storage, up to 20 years, enhances the value and the price at which it can be sold. When it is ready for market, brandy is commonly reduced with water, and perhaps sugar and coloring are added, or blends may be made with other and newer distillations. Imitation whisky is usually made from diluted grain alcohol with a percentage of strong-flavored brandy, some coloring matter and sweetening and a very small proportion of œnanthic ether. Sometimes a little extract of oak shavings or chips is added.

Gin is distilled from a mash of malt and unmalted rye or barley, with juniper berries added while the distillation continues. A very small percentage of turpentine and hops is sometimes added. Gin has a delicate flavor, and contains about 52 per cent alcohol.

Rum is distilled from molasses together with the skimmings of sugar factory kettles and a proportion of the raw juice of the sugar cane. The smaller the proportion of skimmings the better the quality of the product. The usual practice is one part of scum from boiling cane-juice, one part of raw cane-juice, and four parts of diluted molasses. The mixture is fermented in open vats for several days. When freshly distilled, rum is colorless, but it becomes a pale amber color from the casks in which it is stored. Burnt sugar is added to give a darker color. The alcohol content is from 78 to 85 per cent. In the West Indies, especially in Jamaica, the molasses of the sugarcane, which is merely extracted to obtain the sugar, so that the molasses contains no admixtures as it does in our sugar refineries, is fermented and distilled. Its peculiar aroma is due to butyric ether. An inferior grade of rum is made from the sugar scum and beer yeast. Many brands of rum acquire their particular bouquet through the addition of clover leaves, Botany-bark, etc. Artificial rum, made by mixing spirit with rum essence and adding a little coloring matter, can readily be distinguished from genuine rum.

Arrack is made from a mash of rice previously sprouted. It is saccharified at 140° and then cooled to about 70° and a proportion of 10 to 12 per cent "toddy," the fermenting juice of the cocoanut palm, is added to produce fermentation. Sometimes molasses or raw sugar is used, and the toddy omitted. The liquor is distilled two or three times to secure the desired alcoholic content. Arrack is colorless when first made, but gains a yellowish or brownish color from the casks in which it is stored. Its alcohol content is from 70 to 80 per cent.

Vodka is made from a rye mash with from 15 to 20 per cent of green malt, either of rye or barley. In the cheaper grades corn and potatoes are used. Vodka ranges from the minimum of 40 per cent prescribed by law, up to 60 per cent of alcohol.

Sweet fruits, the juice of which is rich in sugar, also serve as raw materials for the spirit industry. The so-called Kirschwasser and Maraschino are obtained from cherries. Besides the juice, the extract also contains components of the cherry stones, which are crushed and added to the liquid.

In the East Indies a liquor is distilled from the fermented juice of the date palm, while in the West Indies the same is done with the fermented juice of the plantain. Pineapples, oranges, apricots, peaches and other fruits can also be made to furnish a liquor.

The large class of various sweet liqueurs, cordials, and ratafias are distillations only of good, fusel-free spirit with an aromatic substance, and the addition of sugar syrup and coloring. The best known are absinthe, anisette, curaçoa, benedectine, boonecamp, crème de cacao, crême de menthe, crême de rose, crême de vanilla and crême yvette (violet).

For statistics of production see DISTILLING INDUSTRY.

RICHARD FERRIS,
Editorial Staff of The Americana.

DISTILLED WATER. See DISTILLATION.

DISTILLING INDUSTRY. There can be no question but that alcohol is one of the most important substances produced by the art of man, for, outside of the extensive consumption of alcoholic liquors as beverages, it is more

extensively applied, and to a greater number of purposes than almost any other manufactured liquid. Notwithstanding, however, there is but one known process by which alcohol can be obtained — the fermentation of sugar or other saccharine matter of plants which contain either free sugar, or a starch convertible into sugar. Commercially, when alcohol is made from grain, it is called grain-alcohol; when it is made from reindeer and Iceland moss, it is called moss-alcohol; when made from potatoes, or beets, root-alcohol, and, if from grapes, wine-alcohol.

Although the first historic mention of alcoholic liquors dates from the 11th century the art of distillation was known for centuries prior to that time. The Chinese had practised it for hundreds of years before it was introduced into Europe, and tradition attributes its discovery to the Arabian alchemists. This art of distillation consists in the process of converting liquid into vapor in a closed vessel by the application of heat and reconverting it into liquid by conveying the vapor into a cooler vessel; so that spirits are not produced by distillation but by the prior act of fermentation; the distilling process separates the spirits from the mixture in which they have previously existed. Brandy, one of the first distilled liquors, was originally known as the "water of life," and one of the early alchemists was so enthusiastic over the discovery of this liquid that he declared that "this admirable essence is an emanation from the Divinity; an element newly revealed to man, but hid from antiquity because the human race was then too young to need this beverage, destined to revive the energies of modern decrepitude."

While brandy and several other distilled liquors had previously been made, the first product of the distillery to reach the dignity of a commercial position was called "rectified whisky." This was a crude high-wine which had been prepared for sale by being passed through a layer of charcoal, a process which was designed to extract the fusel oil. Later, this product was made more saleable by the addition of burnt sugar, some flavoring extracts, and storage in heavily charred barrels, to eradicate some of the rankness and fieriness that distinguished most of such liquors. This method of manufacture was followed until the process of redistilling was invented, when an apparatus was provided by means of which the fusel oil could be more thoroughly extracted from the spirits than had ever before been possible, while, to make the liquor more palatable, a certain proportion of old-fashioned Bourbon from Kentucky, or rye from Maryland, or Pennsylvania, was added to give the bouquet, flavor, and appearance of genuine whisky. In fact, the sale of the goods known as "redistilled whisky" became so general that the proportion as compared to the quantity of genuine Kentucky and other whiskies sold was not less than 15 to 1.

Although the name "Bourbon whisky" now has a wide significance, it was originally used to distinguish the particular kind of liquor that was distilled from Indian corn, in Bourbon county, Kentucky. At that time the yield of Bourbon whisky was about in proportion to three gallons to the bushel, and it was so heavy in body and flavor that it was considered as of great value in the work of compounding, in spite of the fact that it required many years of maturing to neutralize the fusel, and other essential oils which it contained. Popular as this whisky was from the days of its inception, its fame spread so rapidly that it was not long before other distilleries sprang into existence, in Kentucky and elsewhere, and as all of these manufacturers produced an imitation of "Bourbon," the best method of defining that liquor to-day is to say that it is a whisky distilled from corn, after the method which was originated in Bourbon county.

Great as the demand for this whisky was, and despite the fact that the trade was compelled to admit that such goods could not attain to full maturity, the only condition in which they were ready for consumption, within less than the specified three years, the improvements in the process of manufacture were slow. It was at about this time that some important changes were made in the science of mashing, and as these not only increased the yield, but lessened the cost of production, the Bourbon whiskies, which had formerly been used so extensively for compounding purposes, began to attain wider popularity as a beverage. It was also quickly discovered that this increase in yield had not injured the quality of the whisky, but that, on the other hand, such goods were of finer grade, the proportion of fusel oil becoming less though the quantity of whisky increased.

The whisky upon which the reputation of Kentucky so largely depends is that kind of liquor that is known as sour mash, but, unfortunately for the commercial integrity of the distillers, it must be admitted that there are comparatively few establishments that are so careful as to the preservation of their reputations that they will distil nothing but genuine sour-mash goods. At the present time the consumption of whiskies of all grades made in Kentucky is estimated as being nearly 14,000,000 gallons per annum, while the principal States in which ordinary spirits are produced are Illinois, Indiana and Ohio.

Owing to its greater availability and cheapness, grain is the material which is most generally used in the distillation of liquors. Fruits, which are very good for this purpose when they can be obtained, are not only of a perishable nature, but they are not available during the greater portion of the year; thus, while apples, peaches and grapes are used in the manufacture of distilled liquors in California, New York, New Jersey and Ohio, the output is necessarily limited. In the case of fruit brandies, the State of California manufactures more than nine-tenths of the total product of the country.

Rum, which was once one of the popular liquors, is now very little used in this country, being manufactured mainly for export purposes. Made of molasses as the chief material, its distillation is confined almost exclusively to New England, where its production is constantly decreasing, owing partly to the fact that grain-alcohols are cheaper to manufacture, and partly to the steadily increasing popularity of whisky as a beverage. During the past few years several attempts have been made to distil pure spirits from molasses, but none of these experiments have been successful, owing to the

difficulty of eliminating the odor which is characteristic of rum. In the making of pure spirits, no aging is required. Such products of the still are ready for manufacturing purposes, or for compounding, the day they are produced, for, no matter how long they are kept, they cannot be improved. It is such a product that is doctored up by the use of coloring and flavoring to the appearance of genuineness in which it is possible to dispose of it as whisky, and some are even made to produce a fairly passable imitation of the real sour-mash liquor.

In reviewing the products of American distilleries it is necessary to give more than passing attention to the use of distilled spirits in the arts, manufactures and medicines of this country. Among these alcohol and cologne spirits are the most important, although such products as high-wines, whisky, brandy, gin and rum, are also used for these purposes. Pure alcohol is a substance that cannot be obtained by the process of distillation alone. The alcohol, or rectified spirits of the pharmacopœias contain, in the United States, 9 per cent by weight of water, and, in Great Britain, 16 per cent; while the proof-spirits, or diluted alcohol, has 54½ per cent by weight of water in the United States, and 51 per cent in Great Britain. In spite of its general undesirability, there can be no doubt but that great quantities of plain alcohol are used as a beverage, and while it is impossible to collect anything like reliable data upon this subject, it has been estimated that no less than 15 barrels of alcohol are thus consumed in New York city alone every day of the year, and that fully one-half of the alcohol which finds its way to the Northwest is used as a beverage by the Poles, Norwegians, Swedes, Hungarians, Finns and Russians, who abound in that part of the country. It is also a well-established fact that the foreigners who are employed in the coal mines of Pennsylvania are great consumers of alcohol.

In the making of pharmaceutical preparations a large proportion of the cost was due heretofore to the use of distilled spirits in their composition. In some of these denatured alcohol may be used with a great saving of the tax formerly paid, but in many cases in which alcohol would be unsuitable, cologne spirits are used, while such liquors as whisky, brandy, rum and gin, furnish the basis upon which many proprietary medicines, tinctures and medicinal wines depend, not only for their preservative qualities, but for their effect upon the human system. In fact, it has been estimated that no less than 45 per cent of all the distilled spirits consumed in the United States, are used in the arts, the manufactures and in the making of medicines.

Production.— The production of distilled spirits in the United States for the fiscal year ended 30 June 1917, was 286,085,464 gallons. Of this total, 57,651,834 gallons were whisky; 1,870,936 gallons, rum; 5,756,667 gallons, gin; 167,267 gallons, high wines; 134,821,292 gallons, alcohol; and 65,879,886 gallons neutral or cologne spirits. Fruit brandies amounted to 8,251,097 gallons.

The total consumption for the year was 315,374,562 gallons, of which 41,529,677 gallons were exported; 93,762,423 gallons were denatured; and 13,119,201 gallons lost by leakage.

During the year quoted there were 625 distilleries registered in the United States, but only 507 of them were operated. Of these, 198 worked on grain; 284 on fruit; and 25 on molasses.

California led all the other States in the production of brandy, her 148 active stills turning out 7,871,759 gallons — 95 per cent of the output of the whole country. Ohio stood second, with 160,133 gallons; followed by New Jersey, with 54,494 gallons; New York, with 39,019 gallons; and Kentucky, with 34,163 gallons. In the production of spirits from grain, Illinois was first, with 79,320,206 gallons; followed by Indiana, with 43,332,771 gallons; and Kentucky, with 36,407,615 gallons.

In the matter of materials used, no record of the fruit is available. Of grain, the largest item was corn, 33,973,268 bushels; of other grains the figures were: malt, 4,239,677 bushels; rye, 2,375,439 bushels; wheat, 2,538 bushels; all other grains, 78,902 bushels. Of molasses, the quantity used was 112,497,633 gallons. Of the whole product, 114,596,202 gallons were rectified.

The output of distilled spirits for the fiscal year 1914–15 was the lowest since 1909, as may be seen from the following figures:

	Gallons
1908–1909	139,891,613
1909–1910	163,893,960
1910–1911	183,355,527
1911–1912	187,571,808
1912–1913	193,606,258
1913–1914	181,919,542
1914–1915	140,656,103
1915–1916	253,283,273
1916–1917	286,085,464

In connection with these figures should be compared the following stocks on hand in the distilleries and bonded warehouses on the 30th of June of each of the years cited:

	Gallons
1911	249,279,347
1912	263,785,832
1913	276,784,540
1914	282,036,460
1915	253,668,341
1916	232,402,878
1917	194,832,683

These tabulated figures show the enormous increase in the distilling industry since the great war began. This is due in part to the large use of alcohol in the making of munitions, and the prodigious increase in exports, amounting to 2,500 per cent for 1917 over 1915.

The number of establishments in the United States in 1914 devoted exclusively to the manufacture of distilled liquors, as returned by the Special Census of Manufactures, was 434. They had an aggregate capital of $91,285,028. They employed 6,295 hands, to whom they paid in the year the sum of $3,994,469 in wages. With the internal revenue and other taxes these concerns paid into the United States Treasury $147,261,065. The value of the product manufactured was $206,778,708.

In addition to the large production of liquors of which we have record, however, there is no doubt that there are a number of illicit stills throughout the country that are annually producing a considerable amount of distilled spirits that succeed in evading the government's tax, and, consequently, the government's record. These illicit distilleries, which owe their exist-

ence to the inherent repugnance of a certain class of grain growers to pay the heavy tax which the government imposes upon the maker of distilled liquors, are common throughout the sparsely settled regions of the country, more especially, perhaps, in the Southern States. In such sections these small distillers make and sell their product, irrespective of any claim that the government may have in the matter, and as a large proportion of the liquors that are made are consumed in the same neighborhood, it is impossible to obtain any record of them.

Although it is true that the government has succeeded in making the distilling industry one of the most trustworthy sources of national income by the imposition of heavy taxes upon its production, those who are financially interested in the manufacture of liquors are advocating several reforms in legislation, all of which, they believe, will tend to aid the producer in furnishing a wholesome and thoroughly matured beverage at a much lower cost. They hold that the present legislation fails in what they claim should be its primary object — the promotion of the public health and welfare — by enforcing a tax that is so high that its collection naturally tends to bring none but inferior grades of goods within reach of the masses, for the simple and very natural reason that the manufacturer, in order to meet the demands of so great an impost, will sometimes consent to lower the standard of his goods that he may save in a lower quality the amount which he must pay in meeting the tax. It is held by some that this factor is one of the direct reasons for the production of cheap imitation liquors, which are made out of common spirits to be sold practically the same day they are made, whereas the honest maker of genuine whiskies must hold his goods for several years while they are attaining that maturity that will enable him to place them on the market.

The history of the various combinations in which the American distillers have participated during the past 15 years is too long and too complicated a story to be told in so brief a space. Combinations have been formed and have failed, only to be superseded by others, none of which were without some influence in the progress and development of this great American industry. See BREWING AND MALTING; BREWING INDUSTRY; DISTILLATION.

DISTINGUISHED SERVICE ORDER, an order instituted by Queen Victoria 6 Sept. 1886 for the purpose of rewarding the naval and military officers mentioned in dispatches for their distinguished service. Foreign officers who have been associated with British forces in naval and military operations are eligible as honorary members, and the order ranks next to the order of the Indian Empire. The badge is a gold cross, enameled white, edged gold, with the Imperial crown on one side and the cipher of the reigning sovereign on the other, each enclosed in a laurel wreath and worn on the left breast, pendent from a narrow red ribbon edged with blue.

DISTOMA, a trematode or fluke having two suckers, an oral and a ventral, but no other holdfast organs. These forms are the most abundant of the Trematoda (q.v.) and include many important parasites of man and the domestic animals. Of the 30 or more species recorded from the human host the most important are the blood fluke (*Schistosoma hæmatobium*) which is the cause of Egyptian hæmaturia, the lung fluke (*Paragonimus ringeri*) which gives rise to a disease in Japan, Korea and Formosa that simulates pulmonary tuberculosis, and various intestinal flukes that produce grave intestinal disorders. The liver rot of sheep is due to one species (*Fasciola hepatica*) which is extraordinarily abundant in wet seasons in some parts of Europe, where in 1830 2,000,000 sheep died of this disease and even as late as 1891 a single sheep raiser in England lost over 10,000 sheep. This parasite has been introduced into North America.

Adult distomes occur as parasites in all kinds of vertebrates but are almost wanting among invertebrates. The life history is complicated, involving at least two generations with one or more changes of host. The intermediate stages, really generations in the life history, are found first in mollusks and later in various other hosts. Infection of man takes place through the use of water or uncooked foods which contain encysted larvæ of the final generation. No North American fluke attacks man, but one species from the West Indies and several from the Orient are a real menace, with growing intercourse and increased chances of introduction.

HENRY B. WARD.

DISTRESS, or **DISTRAIN** (from the Lat. *distringo*, to bind fast), is the taking of a personal chattel of a wrongdoer or a tenant, in order to obtain satisfaction for the wrong done, or for rent, taxes or service due, or for such damage as result from the trespasses of cattle. The thing taken is also called a distress. The remedy has been for long unpopular, as giving an undue advantage to the landlord over other creditors. It has been abolished in New York, South Dakota and some other States; in Carolina a landlord cannot distrain except in pursuance of an express agreement. In the New England States the law of attainder, or *mesne process*, has been substituted.

DISTRIBUTION. The distribution of wealth or prosperity is to be sharply distinguished from the circulation of goods. The latter refers to the physical movement of goods from place to place and from hand to hand. It is a part of the process of exchange. Distribution, however, refers to the relative well-being or prosperity of the various individuals or groups of individuals who perform various parts of the great and complex task of providing for the needs of the community.

The problem of distribution, like that of exchange, grows out of the division of labor. In a primitive, self-sufficing system of economy, where every one produced everything which he consumed, there would, of course, be no exchanging. Neither would there be any problem of distribution, because every one would consume his own products and his prosperity would be an individual and not a social problem. But in an economic system where each worker does that for which he is best fitted, instead of producing everything which he needs, it is of course necessary that goods and services should be exchanged. As the result of this process of specialized production and exchanging, each one finds himself, at the end of the process, in possession of a greater or a smaller quantity of

goods. Distribution has to do with this final result, that is, with the quantity of goods which each worker or group of workers gets as a reward for his or their part in the complicated work of production. The reward of the different participants in the work of supplying the needs of the community determines their relative prosperity.

Production and exchange are processes, but distribution is a result. Prosperity is, in a sense, the end and purpose of all production and exchange. Not all prosper alike in any economic system except pure communism. The relative prosperity of different classes, or the differences in prosperity and the causes of those differences are the problems of distribution.

Division of labor is of several kinds, the more important of which are territorial, temporal and occupational. Territorial division of labor, of which international division of labor is one phase, is a system under which considerable regions, such as the cotton belt, the corn belt, the mining regions, etc., specialize on certain products, shipping their surplus out to other regions, and shipping in the specialized products of those other regions. Temporal division of labor is a system under which the same substance is worked upon at different times by different industrial groups. Wheat, for example, is produced by one industrial group, ground into flour by another and baked into bread by still another. Hides, likewise, are grown by one group, tanned by another and made into shoes by still another. Occupational division of labor is a system under which, in the same industrial group, such as the milling, baking, tanning or shoe-making groups, various kinds of skill have to be combined in order to get the best results.

Each of these kinds of division of labor has its own peculiar problems of distribution. Under the territorial division of labor, one region may prosper and another not. Under the temporal division of labor, one industrial group may get a large and another a small share of the total value of the finished product. In the same industrial group, they who follow one occupation, or supply one of the factors of production, may get a large and others a small share of the value created by the work of the groups. The causes of these inequalities are the problems of distribution, and they are the most important problems in the whole field of economics.

Inequalities in the territorial distribution of wealth or prosperity are not so very difficult to explain. If cotton, for example, is produced in excessive quantities, it helps the other regions which buy cotton, but it impoverishes the cotton belt which has cotton to sell. Other regions can get plenty of cotton in exchange for small quantities of their own special products, while the cotton belt, at the same time, gets small quantities of other things in exchange for large quantities of cotton. Vice-versa when cotton is undersupplied, provided it be not because of crop failure or other disaster, the cotton belt becomes prosperous and other regions relatively unprosperous. They who have cotton to sell can get large quantities of other goods for the proceeds of the sale of small quantities of cotton. The same principle applies to corn, wheat, coal or any other special territorial product.

The inequalities in the distribution of wealth or prosperity among the various industrial groups which work in succession upon the same material is likewise easily explained. The wheat-growing group, for example, gets its reward in the form of the price of wheat. The flour manufacturing group gets its reward in the form of the difference between the price of wheat and that of flour and its by-products; and the baking group gets its reward in the difference between the price of flour and that of bread.

If there should be so many wheat farmers and so few millers as to produce a bad balance, then each individual farmer would cease to be indispensable. He could stop growing wheat, and there would still be as much wheat as the millers could grind. Each mill would, however, become at the same time practically indispensable. If it should close down, it would seriously curtail the supply of flour on the one hand and reduce the market for the farmer's wheat on the other. Under such circumstances the reward of the milling group, that is, the difference between the price of wheat and that of flour and its products would be large. In short, the milling group would be prosperous because a large share of the total price of bread would go to it and a small share to the farming group. Vice-versa if there were so few wheat farmers as to provide an insufficient supply to keep the existing mills busy, the distribution of prosperity would be reversed. Whether it be wheat, hides, iron or any other product which passes from one industrial group to another, the question of the distribution of prosperity among the various groups would be the same.

The great social problems of the present, however, relate to the distribution of wealth or prosperity among the various members or classes in the industrial group. How much of the price of wheat, for example, should go to the landowner as rent, to the farmer as profits, to the capitalist as interest and to the farm laborer as wages? Again, how much of the total reward of the milling group should go to the owner of the site as rent, to the owner of the equipment as interest, to the business head as profits and to the various classes of laborers as wages? This is the problem of occupational distribution. The growth of large industries, with greatly increased numbers of interests to be conserved in each industrial group, has given to this problem its complexity. The vast differences in the prosperity of the different classes who participate in the work of the same industrial group has made this the most acute of all economic problems.

The principles which determine the relative prosperity of different classes within the industrial group are practically the same as those which determine the relative prosperity of territorial and of industrial groups. If, for example, two kinds of skill are required in the manufacture of a given product, and one kind of skill is so abundant and the other so scarce as to produce a bad balance, no individual possessing the kind of skill which is oversupplied can claim to be indispensable. The mill or factory can produce approximately as much without him as with him. Since he can be spared without great loss, he must work, if he works at all, at low wages. Each individual, however, who possesses the kind of skill which is scarce

may be said to be practically indispensable. It will make a considerable difference in the output of the whole establishment whether he works or not. He cannot well be spared and he can therefore dictate good terms for himself. In short he will be well paid.

Unskilled labor is generally oversupplied in proportion to skilled labor, and managerial talent is generally the scarcest form of skill. Thus it happens that no individual unskilled worker is in any sense indispensable. There are so many others available that any one can be easily spared. So long as this condition exists, unskilled laborers will never be able to command a large share of the value produced by the group of which they are a part. For the same reason, so long as the same conditions prevail, the more nearly indispensable the individual becomes, the larger the share of that value he will be able to command.

Various kinds of skill, however, are not the only factors of production. Adequate supplies of capital are equally necessary, and in some cases, suitable land, favorably located, is also indispensable. Whether it be land, capital or skill, the more nearly indispensable the factor is, the more it will command of the total product of the establishment.

This being the case, the obvious cure for the inequalities in the distribution of prosperity is a balancing up of the factors of production, so that no factor and no kind of skill is either oversupplied or undersupplied relatively to all others. With an abundance of available sites, no landowner could command an inordinate rent for his land. With an abundance of capital, no capitalist could command inordinate returns for his capital. With an abundance of managerial skill, no executive or business manager could command an inordinate income either in the form of profits or salary. At the same time, if unskilled labor were scarce and hard to find, so that each one could be considered as practically indispensable, no laborer would be compelled to work for low wages.

In addition to a program for the balancing up of our industrial system, we must, of course, eliminate all injustices, such as monopolies and other methods of creating artificial scarcity. See ECONOMICS.

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DISTRIBUTION OF ANIMALS. See DISTRIBUTION OF LIVING MAMMALS; ZOÖGEOGRAPHY.

DISTRIBUTION OF DISEASES. It is well known that certain diseases without relation to climate are found only within certain well-defined areas; instances are pellagra confined to Lombardy and beriberi to Ceylon and Malabar. Climate, however, is a very important factor and together with the popular habits and customs determines the prevalence or absence of certain diseases in certain parts of the world. The tropics are the recognized home of malarial fevers and cholera, in the spread of which the warm damp soil and rotting vegetation plays a large part. Typhus, typhoid and scarlet fever prevail in the temperate zones, and their spread is due principally to overcrowding in the densely populated section of these zones. Tuberculosis and other pulmonary diseases are commoner in northern latitudes. Consult Annesley, 'Researches into the Causes of Diseases in India' (London 1855); Manson, 'Tropical Diseases' (4th ed., New York 1907); Martin, 'Influence of Tropical Climates on European Constitutions' (London 1877); Clemon, 'Geography of Disease' (Cambridge 1904); Daniels, 'Tropical Medicine and Hygiene' (New York 1913); Davidson, 'Geographical Pathology' (Edinburgh 1892).

DISTRIBUTION OF LIVING MAMMALS. Mammals live in practically all parts of the earth, both on land and in the sea, excepting the icy deserts of interior Greenland and about the South Pole. The diversity of climate and other physical conditions within this vast area, during both past and present time, has furnished an endlessly varied environment and the characters of the multitude of successively extinct mammals in the fossil beds of the geologic ages show that the group of mammalia has always had a most plastic organism. The mammalian types now inhabiting the earth by their wonderful variety present living evidence of this fact. They range from the tiny shrew weighing less than an ounce to the elephant and the whale, weighing tons; from the clumsy mole to the winged bat, excelling the birds in some of its powers of flight; and from the stupid sloth to man. As we see them mammals appear to fit so perfectly into their environment that at first glance the various species might be considered to have always existed in their present haunts. The occurrence of closely related living species in widely separated areas and the evidence of the fossil records indicate strongly that the ancestors of much the greater proportion of living mammals probably had their origin far from their present homes. The distribution of existing mammals is merely the latest chapter of a wonderful story leading back through the geologic ages and involving almost incredible changes in the earth's surface and the relationships between land and sea. The fossil beds prove that in practically all regions one fauna has succeeded another, often of the most diverse character, in a marvelous procession.

So far as distribution alone is concerned the mammals may be divided roughly into two main categories, each rather definitely limited. First, those which are characterized by having the four limbs more or less completely developed for life on the land. Second, those which have all of their limbs greatly modified, and sometimes with the posterior pair lacking, in order to fit them for life in the sea. Land mammals, living among infinitely diversified conditions, are correspondingly much varied in size, form, color, specialization of organs and habits. Sea mammals living under far more uniform conditions present much fewer and more uniform types which are included within the three great groups, the whales, the pinnipeds or seals, and the sirenia or manatees and their relatives. The seals and larger whales are most characteristic of the colder northern and southern seas, while the smaller whales or dolphins and the manatees are most characteristic of the warmer seas and some of their tributary rivers. The present distribution of land mammals has resulted from the interaction of numerous

causes many of which are little understood or are unknown. Temperature is known to be the most potent single influence. A long continued change of 10° F. in the average summer temperature of any region would have a marked influence on its mammal life; many species would disappear and be replaced by others. We have reason to believe that such changes in temperature have been the primary causes of many of the great changes in mammalian faunas in various parts of the earth which have been revealed by studies of the fossil beds. The distribution of species is strongly affected also by the prevalent degree of atmospheric humidity, as indicated by the contrasting faunas of hot desert areas and of the mighty forests of the humid tropics. Oceans, great rivers, high mountain ranges and elevated tablelands form barriers which also affect the distribution of mammals. The Sahara Desert is believed to have existed since a remote period and forms an effectual barrier against the spread of mammals living adjacent to its borders. In the same way great forested areas in other parts of Africa and elsewhere have their peculiar species and bar the way to species living on the open plains. Elevated mountain ranges, especially those extending in a northerly and southerly course, and high interior tablelands directly influence climate conditions and the animal life on them. For instance the great mountain system of western North America carries southward to within the tropics representatives of the characteristic northern mice of the genus *Microtus*. The broad interior tableland of Mexico carries southward from the southwestern border of the United States to the valley of Mexico the pocket mice (*Perognathus*), the kangaroo rats (*Dipodomys*) and others, while along both lowland coasts of that country tropical species of mammals such as peccaries (*Pecari*) and tiger cats (*Felis*) range northward to our border.

The distribution of both the recent and the fossil mammals plainly indicates that numberless species have passed from their original home across land bridges to other continents where they are now isolated by the disappearance of the bridges beneath the sea. In many instances the species has no surviving representative in the region of its origin. For ages Asia appears to have been a vast and fecund nursery for the production of mammal types which passed thence to other parts of the earth. Most of the mammals now inhabiting temperate and Arctic North America were evidently derived from northern Asia by way of a land bridge which united the continents in the region about Bering Strait. By this route came the ancestors of our moose (*Alces*), elk (*Cervus*), caribou (*Rangifer*), mountain sheep (*Ovis*), mountain goat (*Oreamnos*), pronghorned antelope (*Antilocapra*), musk ox (*Ovibos*), wolves (*Canis*), foxes (*Vulpes*), bears (*Ursus*), wolverine (*Gulo*), marten (*Martes*), otter (*Lutra*), Arctic hares (*Lepus*), woodchucks (*Marmota*), field mice (*Microtus*), lemmings (*Lemmus* and *Dicrostonyx*), and others, nearly all of which still have close relatives living in northern Asia and Europe.

Similar proof of former land connection between now distant areas is afforded by the distribution of other species of living mammals. This is well illustrated by the distribution of the marsupials, an extremely ancient group which, as shown by fossils, was once widely distributed in northern continents. They are represented to-day only by the opossums of South and Middle America and by the kangaroos and numerous other marsupials which in form and habits resemble our mice, moles and carnivores, in Australia and neighboring islands. Equally good indication of former land connections is given by the existence of tapirs in tropical America and in southeastern Asia; also by the octodont rodents now peculiar to tropical America and Africa as well as by the monkeys of the Old and New Worlds. Land bridges are believed to have once united South America, the Antarctic continent, and Australia on one side, and to have joined Brazil and West Africa on the other.

The comparative length of time during which certain land areas have been separated is at times indicated in a marked way by the degree of differentiation between the related mammals of the regions. The geologically recent union of northern North America and northern Asia is clearly indicated by the close likeness between the living mammals of the two regions. The converse is shown by the monkeys of South and Middle America which, having a close external resemblance to Old World species, have also certain fundamental structural characters not known to occur in any living or extinct Old World forms. This indicates that the New World animals branched from the parent stock at a remote period and have developed free from any subsequent interchange between the old and new continents. It is interesting to note that the man-like monkeys, including the gorilla, chimpanzee and orang, are limited to Africa, southern Asia and the islands off its southeastern coast. The long isolation of Australia and the surrounding islands is indicated by the presence of a mammal fauna made up mainly of marsupials, an ancient group of animals once widely spread but now extinct elsewhere except for the American opossums. Aside from the bats Australia has representatives of only a few groups of modern mammals, mainly the mice and rats of the genera *Mus* and *Rattus* of the rodents, and the dingo or wild dog (*Canis*), belonging to the carnivores, which may have been introduced by man. Madagascar is another example of an area separated from other lands since a remote period, its most characteristic mammals representing types which exist nowhere else to-day, but of which fossil remains occur in adjacent parts of Africa. The recent great abundance and variety of large mammals in North America, both of species and individuals, is in strong contrast to the situation in South America. In the north we have the bison, musk ox, mountain goat, pronghorned antelope, mountain sheep, elk or wapiti, several well-marked species of deer, caribou, and an unequalled variety of bears, including four types, the polar, the black, the grizzly and the huge brown bears of Alaska. To offset these, South America outside the tropics has only two or three deer, the guanaco and vicuña (from which have come the domesticated llamas and alpacas) and the spectacled bear. The fauna of the tropical parts of South and Central America has many distinctive types of smaller mammals, including the prehensile-tailed

monkeys, marmosets, coati-mundis, peccaries, agoutis, prehensile-tailed porcupines, sloths, armadillos and anteaters. Both the scarcity of large mammals in South America and the number of surviving peculiar types evidence the long isolation of that continent from contact with other lands on either side. Certain groups of mammals are typical of cool regions, such as the moose, caribou, musk oxen, marmots and lemmings of northern parts of the Old and New Worlds. Others like the monkeys are typical of the tropics. Some mammals appear to be indifferent to climate conditions as in the case of the mountain lion (*Felis concolor* and its geographic races), which ranges from southern Canada to Patagonia, and appears to be equally at home among the sun-scorched desert ranges of the southwestern United States, the cool slopes of high mountains and the gloomy depths of the vast tropical forests of Central and South America, amid almost constant rains. A similar hardiness is shown by the tiger of the Old World which has representatives from the hot lowlands of southern India to the valley of the Amur River in eastern Siberia, where Arctic temperatures prevail in winter. The distribution of certain species serve as unmistakable records of former climatic conditions, as in the case of the field mice (*Microtus*) which occupy high isolated mountain tops in southern Mexico and Guatemala, separated from their nearest northern relatives by intervening tropical lowlands. It is evident that they spread southward while a suitably cold climate prevailed on the lowlands, and with the change of climate were forced up and stranded on the elevated islands they now occupy. This discontinuous distribution on mountain ranges is as significant as is the existence of closely related types on islands and on distinct continental lands, although they may be separated by a broad and deep expanse of the sea. Isolation on islands, and to a lesser extent on high mountains, where competition from invading species may be mainly or entirely absent tends to preserve the representatives of ancient forms long after they have vanished from other parts of their former range. Both Australia and Madagascar are extreme examples of the effect of isolation in bringing down to recent times representatives of ancient faunas which have become elsewhere extinct. The relation of the distribution of living mammals to their near kin of the geologically not distant past is well shown by the discovery on the open plains of North America of fossil remains of several types of antelope now abundant on the plains of Africa. Camels, once occurring from the coast of Florida to the Pacific, now exist in the feral state only in central Asia. They have living relatives, however, in the guanaco and vicuña of South America. Members of the elephant tribe, once common in most parts of the world, exist now only in Africa and southern Asia. Fossil remains abundantly prove that the horse developed on the great plains of North America where it existed in extraordinary variety of size and form. At the time of the discovery of America the horse had completely vanished from its confines, although representatives still survived in the wilds of Asia and Africa. The fact that the horses brought by the Spaniards to America found the plains on both continents perfectly adapted to their needs, and going wild increased enormously, renders still more inexplicable the cause of the disappearance of the original stock from these haunts. In the past many mammals of extraordinary size existed in various parts of the world which are now represented by smaller species. Among these may be mentioned the giant deer of the Irish peat bogs, the huge extinct marsupials of Australia, the gigantic armadillos of South America and the great wolves and lions of southern California.

The distribution of certain genera is extremely restricted. The genus *Romerolagus,* an aberrant rabbit having but a single species without near living relatives, is confined to a narrow belt about the bases of the adjacent volcanoes Popocatapetl and Iztaccihuatl on the border of the valley of Mexico, although exactly similar slopes with the same soil and vegetation exist on other mountains distant only a few miles. Another example is the curious rodent genus *Aplodontia,* confined to damp forests of the northwestern United States and represented by a single species. Such mammals are, no doubt, survivors of groups once having far wider distribution and more varied forms, and their present restriction in variety of form and extent of range is a forecast of approaching extinction. The llamas and alpacas of South America are similar survivals of once widely spread types. In strong contrast to such restricted distribution may be cited other genera which contain many forms, abound in individuals and occupy vast areas of the earth, thus indicating a vitality and attendant fecundity as well as a youthful plasticity of organization able promptly to respond to the requirements of changing conditions. The genus *Lepus,* which includes the hares, is perhaps the most notable of such groups. It has representatives throughout most of Africa, Europe, Asia and North America, including in its range the northern end of Greenland and the tropic lowlands. The meadow mice of the genus *Microtus,* numbering many species and untold millions of individuals, occupy most of the lowlands and mountain ranges of Europe, the northern half of Asia and America north of Mexico. The vast range of the hardy puma (*Felis concolor*) has already been mentioned. The disappearance from the earth of once abundant and widely spread species of mammals when climatic and other conditions appear to remain the same presents an unsolved problem. The mammoth, cave bear, and other large species now extinct, ranged the plains of northern Europe and Asia as late as the time of the Cave Men, while the reindeer and other animals contemporaneous with those named and apparently no better fitted for existence still survive. It has been wisely suggested by Lydekker as probable, among the many factors which influence the disappearence of species and even of larger groups of mammals and other forms of animal life, that each species or even much more important groups may, like the individual, have its period of youth, maturity and decay, leading to loss of vitality and final extinction, to be replaced by vigorous newcomers in the endless succession of life. The reasonableness of the foregoing surmise is shown by the facility with which certain species of birds and mammals have been known to decrease and even disappear within a very recent period. One striking instance within the

last 30 years is the inexplicable disappearance of various species of birds in the Hawaiian Islands with no change in their habitat sufficient even remotely to account for it. Their extinction appears to have been due to a lack of enough vitality to withstand the trifling encroachment on the great expanse of their forest homes following the advent of civilized man. The steadily decreasing numbers of the prong-horned antelope on the open plains of the western United States and northern Mexico is no doubt in part due to its small powers of resistance to changes in environment brought by the increased occupation of its territory by man and domestic animals. The lack of ability to resist changes on the part of the prong-horn is strikingly shown by the difficulty experienced in keeping them alive in zoological parks and to maintain small herds of them in fenced government game preserves containing thousands of acres in the midst of their former haunts. In these same parks and preserves, buffalo, elk and deer thrive and increase rapidly.

Man appears to have originated in the Old World and to have become the most widely distributed of all mammal types. The genus *Homo* has broken up into a considerable number of specific types which had originally as clearly defined geographic distribution as the lowest of mammals. With the development of civilization man has more and more tended to lose these local distinctions and to obscure the original boundaries of races by migrations at will to all parts of the earth. The weaker species of man disappear before the stronger, as occurs among other forms of animal life.

No treatment of the distribution of recent mammals can well avoid the consideration of the potent influence of man. Although man is the latest type of mammal to appear on the earth he rapidly developed a dominant position and spread to all lands where he has determined the survival or destruction of numerous species, and his influence in this respect is rapidly increasing. From the most primitive times up to the present animal products, including flesh, fat, hides, ivory and others, have been necessary to man's welfare and have formed valued articles of commerce which has led to persistent pursuit and slaughter. In addition man has domesticated the horse, cattle, sheep, goats, pigs, dogs and cats, which he has taken with him to other lands where under his protection they have enormously increased to the injury of most native mammals, both great and small, with which they have come in competition. The present situation in the United States is an illustration of this in the presence of many millions of domestic animals, and the vast decrease in all the larger game animals, such as bison, elk, deer, antelope and mountain sheep, since the settlement of the country. Not all, by far, of this harmful influence on the native mammal life can be laid to the domestic animals, for the improvement of weapons of the chase and of means of transportation coupled with the hunting instinct which persists in man are ever-increasing menaces to the welfare of the surviving large and small mammals which offer any value as game, as bearers of fur or as the producers of commercial products. This danger extends to the species living in the sea as well as to those on land. The increasing occupation and cultivation of the land is another of the factors introduced by man whereby the existence and orderly development of the higher forms of life on the earth is being more and more disturbed and in many instances jeopardized.

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DISTRIBUTION OF PLANTS. See PLANT GEOGRAPHY.

DISTRICT, a term ordinarily meaning a region, a tract of land, a territory, but in the United States usually employed to designate a political subdivision of a State, county or city fixed for purposes of legislative or congressional representation, either under a law enacted by the legislature or by the adjudication of a court in which this power may be vested. The term has been used historically and currently in several senses. It was applied to organized bodies of territory administered by the Federal government because they were not populous or compact enough for territorial institutions or for other reasons were withdrawn from that system. Examples are the District of Columbia, first district, then territory, then district again; Alaska before its territorial organization; and from 1804–12 that portion of the Louisiana Purchase north of the present boundaries of the State of Louisiana. Until late in their history the counties in South Carolina were called districts.

State Districts.— The term is used also to designate a State or that portion of a State which constitutes the seat of jurisdiction of a United States court, such districts never crossing State lines. See COURT.

Congressional Districts are marked off by the State legislature after the apportionment of representation in Congress has been made by that body, which bases its action upon the decennial census. (See APPORTIONMENT; CONGRESS; ELECTIONS). These districts must consist of contiguous and compact territory and as nearly as possible must contain an equal number of inhabitants. Congress has power to alter or to override entirely the regulations made by State legislatures as to the times, places and manner of holding elections, but this power was not exercised until 1842 when an apportionment act was passed providing that members should be elected by districts instead of by general ticket. Under the Constitution the senator and the representative must be «an inhabitant of that State» in which he is chosen but in some States the two senators have been taken from different sections or districts, while in Maryland for 75 years a statute required that one of the senators be elected from the «eastern shore.» Custom or law now requires that members of the House reside in the district from which elected. Since no definite rule governs the manner of redistricting a State after a new apportionment, oftentimes the party in control of the legislature will perform this work in such a way as to secure for itself a number of congressmen larger than warranted under its share of the popular vote. See GERRYMANDER.

State Senatorial Districts follow county lines in most States, especially in New England, where the county itself is usually the basis

for senatorial representation. In the newer States, after each decennial census, the State is redistricted for the ensuing elections of the fixed number of senators. Minnesota and Illinois are the only States wherein election districts serve for the election of members of both houses of the legislature. In some States unequal senatorial representation occurs, sometimes because a senator is accorded to each political unit (as in Rhode Island, where each town or city is represented by one senator), and sometimes because limitations are imposed with the intent to restrict the influence of any one city (as in New York, where no county may be represented by more than one-third of all the senators).

State Assembly Districts are usually redistricted after each decennial census, the unit of representation being the town in some of the older States, particularly in New England. In Vermont each town may elect only one representative; in Connecticut each town or city may send two but no more and no town which in 1818 elected two representatives has had its representation reduced. As a result the city of New Haven with 150,000 population has no larger representation in the legislature than the town of Union with only 400 population. For convenience each State assembly district is usually subdivided into *election districts* or voting precincts, the number depending upon the size or population and the ratio of apportionment decided upon by the board of elections.

City Districts.— For administrative purposes cities are usually divided into districts such as police, fire, school, park, sewer, sanitary and election districts. Sometimes for taxation purposes, cities are districted, particularly if special assessments be imposed for public improvements, the tax rate varying in the several districts. The charters generally establish these districts outright, confer the power to change their boundaries or delegate authority to establish them. In some cities are territorial subdivisions known as wards, which are established for specific civic purposes, such as units of representation in the city council, and for police, taxing and election districts. They sometimes constitute an important part in the organization of political parties. See CITIES, AMERICAN, GOVERNMENT OF.

Taxing Districts.— Under a decision of the Supreme Court, a taxing district is any section of a State described in a statute or order as to be assessed, without respect to the civil or political divisions which may have been made for election purposes. A remarkable instance was the city of Memphis, Tenn., which, when ruined by plundering politicians, abandoned its city charter and constituted itself the taxing district of Shelby County, to escape suits against the city as a corporation. See also TAXATION.

Internal Revenue Districts are established for the collection of internal revenue and come under the supervision of the Treasury Department. The country is divided into 66 districts, each in charge of a collector; as a rule the districts follow the State lines, but the revenues from some States are so large that the States are divided into several districts, as New York into six, Kentucky into five and Illinois into four. See INTERNAL REVENUE SYSTEM.

Customs Districts have been established to administer the tariff laws and to collect the customs duties. (See DUTY.) In each of these districts is a port of entry and in several of these ports the collections are made by a staff of officials, consisting of a collector, appraiser, naval officer, surveyor, inspectors and gaugers, the number varying with the size and commercial importance of the port.

Rural Districts and Divisions.— The counties of the Southern and far Western States and the towns and townships of the North Central and North Atlantic States are divided into smaller districts for special local administrative purposes, such as elections, fire, schools, roads, health, water, etc. In the South and Far West, country districts are generally larger than the subdistricts of towns or townships in other States, and to some extent have supplanted the system of township government. The other rural administrative districts, such as county council, town, borough, village, etc., are discussed under their individual headings.

Election Districts sometimes comprise an entire town or township, but the larger towns or townships of the North Atlantic and North Central States often contain more than one voting precinct, especially where a town consists of two or more villages. See ELECTIONS.

Fire Districts seldom conform to other boundary lines; in villages and smaller cities the fire district comes within the village or city limits. Fire companies are strictly regulated as to their response to alarms in a particular district, but such companies are often called from one village to the aid of nearby towns or villages. Most States have a fire marshal whose principal duty is the prevention of fires. See also FIRE PROTECTION; BUILDING LAWS.

Health Districts are confined to counties. The health officer and his assistants are usually county boards, having jurisdiction throughout the county, and their chief work is to prevent epidemics and to create satisfactory sanitary conditions. See SANITARY SCIENCE AND PUBLIC HEALTH.

Water Districts generally coincide with the village or city limits and usually come under municipal jurisdiction. In States having large irrigation systems the water district often constitutes an important administrative unit. See also WATER SUPPLY; WATERWORKS.

Poor Districts may coincide with the limits of the county or township, some States having both systems. The county supports an infirmary and persons unable to enter the infirmary must be aided or supported by the townships. See also PAUPERISM; CHARITIES, PUBLIC.

Road Districts.— Most country roads in the United States have been constructed or repaired by a labor or poll tax under the direction of road supervisors or overseers of road districts into which the counties and towns have been divided. These supervisors may be elected by the road districts or appointed by the township trustees, their duties being to superintend the road work which must be performed by each male citizen between certain fixed ages. Until recently Ohio permitted cities and villages to require two days' labor on the streets. In the Southern and Far Western States the county officials usually appoint the district road officers but they are elected by each district in Idaho and Washington. In most of the North Central and North Atlantic States the local road officials are usually town officers, in some States the

road supervisors being appointed by the town; but in many of these States county and State officers now supervise the more important roads. See ROADS, IMPROVEMENT OF.

School Districts are areas set apart as units of organization for the local control and administration of school affairs; in most States these districts are regularly incorporated, with their own power of taxation. The limits of the township school district usually are the same as those of the civil township, but the school affairs are administered by a separate board, which may or may not consist of persons chosen by each subdistrict. Independent districts may be formed in townships, which constitute a school district; or, upon vote, all of the township's subdistricts may be constituted independent school districts. Hence a county might have townships with only subdistricts, or only independent districts, or a combination of both. The independent school districts were first established in Massachusetts in 1789 but were finally abolished in 1882. In the North Atlantic and North Central States towns and townships were formerly very generally subdivided into petty school districts but the present tendency is to make the town the primary unit for school administration. Small school districts prevail, however, in Rhode Island, Connecticut, New York, Illinois, Michigan, Kansas and Nebraska, while an entire township or one of its subdivisions may still constitute a school district in Minnesota, Wisconsin, North and South Dakota. In the Southern States bordering on the Atlantic and in Louisiana, where the township has not been fully established, the officers of the district are appointed by the county school officials, who also must establish the school district. The district may coincide with the civil or magisterial district and may elect its own trustees, as does the township in the North. In the other Southern States and some of the Far Western, counties are regularly divided into school districts which in most cases are distinct municipal corporations. In other Far Western States districts may be designated by county boards or by the county superintendent of schools, but the trustees are selected locally and tax levies for school purposes are controlled locally. See also SCHOOL SUPERVISION; SCHOOLS, COUNTY TRAINING.

Judicial Districts.— For purposes of electing justices of the peace, the counties in many Southern and Far Western States are regularly divided into districts; and some States have districts for the election of county boards. These are called magisterial districts in Virginia, West Virginia and Kentucky; civil districts in Tennessee; and judicial townships in California. In some places these judicial districts are used as election precincts.

Other Rural Districts.— Sometimes districts are specially established in certain localities to conduct public works affecting two or more of the regular local districts. Among such special districts are the levee districts along the lower Mississippi and the drainage districts in Illinois.

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DISTRICT OF COLUMBIA, the national capital and its adjoining territory, owned and administered directly by the United States government, to prevent its action being hampered by conflicts with local jurisdictions. It consists of 60 square miles of land and 10 of water on the eastern side of the Potomac, at the head of deep-water navigation; an enclave in Maryland, with three rectangular sides and the fourth following the lines of the river, besides the islands in the tidal river. Near the southern side of the district, forming the eastern and southern boundary of the city of Washington, is the large tidal estuary of Anacostia River or the eastern branch of the Potomac; the northwest boundary is formed by Rock Creek, separating Washington proper from Georgetown. There are several brooks. The district is flat and marshy for some distance back, then rises into gentle hills and swells; there is pleasing scenery along Rock Creek. The geological formation is Cretaceous, overlaid with drift; in the latter has been found the conglomerate called breccia, from which handsome columns have been carved, used in the capitol. The soil is light, and especially suitable for market-gardening, to which with dairying and the pasturage for the cows it is chiefly devoted, outside the built-up sections. The nature of the capital as a "court city" gives flower-gardening a great importance, and over $500,000 worth are sold annually. The farms are very small — about 35 acres for white and 18 for colored occupants. But little over a fifth of the surface is in farms, however; the city and its suburban village, the great National Park, and reserved grounds of various kinds, taking up most of it. The climate is excessively variable, but generally humid and warm. The rainfall averages 50 inches a year.

The District originated in the politics of the Confederation time. Until the adoption of the Constitution, the Continental Congress assembled on 10 occasions at eight different places in succession, at Philadelphia, Baltimore, Philadelphia, Lancaster, Pa., York, Pa., Philadelphia,

Princeton, N. J., Annapolis, Md., Trenton, N. J., New York. The first five were during the Revolution. On 21 June 1783, a band of unpaid militia broke up the session in Philadelphia by hooting the members and pointing muskets in at the windows. This emphasized the need of a district guarded by Federal troops, and on 7 October Congress resolved to erect a building near the falls of the Delaware (Trenton). The jealousy of the South, however, demanded one also near the falls of the Potomac, and alternate meetings in the two. Finally a majority abolished the second proposition, and a committee was appointed to lay out a town as first voted. There was no money under the Confederation, however, to build or do anything else, and no action was taken on the committee's report. It had been voted to meet in New York till the Federal town was ready; but this was disliked from fear of the "money power" corrupting or overbearing Congress. Philadelphia was proposed, but objected to by the Southerners because the Quakers favored abolition. The first Congress under the Constitution revived the government-district plan, but on the banks of the Susquehanna. Finally Jefferson gave a dinner and arranged a "log-roll": two anti-Federalists from the Potomac region, who had voted against the assumption of the State debts by the national government, changed their votes on condition of the Federalists voting to fix the new capital on the Potomac, after remaining 10 years at Philadelphia. The act was passed as agreed 28 June 1790, for establishing the seat of government "at some place between the mouths of the Eastern Branch and the Connogocheague." The first session of Congress was to be held in the new place the first Monday in November 1800. Maryland in 1788 ceded Washington County, and Virginia in 1789 Alexandria County, forming a district 10 miles square; Washington in person laid it out under the act of 30 March 1791 (having previously sold all his lands in the vicinity). The territory selected included the site of Powhatan's village, Anacostan or Nacochtank; also the existent village of Georgetown, laid out in 1751 and incorporated in 1789 — both on the Maryland side; and on the Virginia side, Alexandria, formerly Belhaven. The site of the new capital itself had been the plantation of one Pope, classically inclined, who by a curious prevision called his hill the Capitol and a brook near by the Tiber. Until 9 September the site was called "The Federal City"; then, by order of three commissioners appointed by President Washington, the district was named "The Territory of Columbia," and the city "The City of Washington." For the latter, see that title; also CAPITOL, where is noted the project, after its burning by the British, of removing the capital north, which was carried by the speaker's casting vote, but buried in committee. In 1846 no Federal buildings having been erected on the Virginia side, nor likely to be, Alexandria County was retroceded to that State upon the petition of the inhabitants thereof, by a vote of 763 to 222. In 1871 the business men of the District, fretting under their political nullity, it was constituted a Territory with a governor and legislature, and delegates in Congress; but was at once seized upon by a ring of speculators who obtained control of its government and plundered it into bankruptcy. In 1874 the territorial government was abolished and direct government by Congress restored through three commissioners appointed by the President and confirmed by the Senate.

The commission of 1874 was a temporary government; in co-operation with Congress and the citizens of the District, it framed as a permanent system the act of June 1878, which the Supreme Court has pronounced "the constitution of the District of Columbia." Under this act half the expenses of the District, previously laid entirely upon the residents, are paid by the national government, as the owner of more than half the real estate. There is no popular suffrage, the entire executive government being in the hands of commissioners appointed by Congress; they recommend legislation and appropriations to the latter, which in turn consults them in the same matters. The government, though not appointed by popular vote, is nevertheless swayed by public opinion; and so excellent that agitations for restoration of suffrage meet no support. The judiciary of the District dates from 1801.

Population.— 1800: Washington, 8,144; Alexandria, 5,949. 1810: Washington, 15,471; Alexandria, 8,552. 1820: Washington, 23,336; Alexandria, 9,703. 1830: Washington, 30,261; Alexandria, 9,573. 1840: Washington, 33,745; Alexandria, 9,967. 1850: Washington, 51,687; 1860 (same), 75,080; 1870 (same), 131,700; 1880 (District of Columbia), 177,624; 1890 (same), 230,392; 1900 (same), 278,718, of whom 218,196 were in Washington proper and 14,549 in Georgetown. Of these, 20,119 only were foreign born; but 87,186 were colored; (1910), 331,069. In 1913 the population was (police census), 353,297. There was in 1913 a very small foreign-born population, but the negro element was large — 98,144.

DISTRICT OF COLUMBIA, Courts of. See COURT.

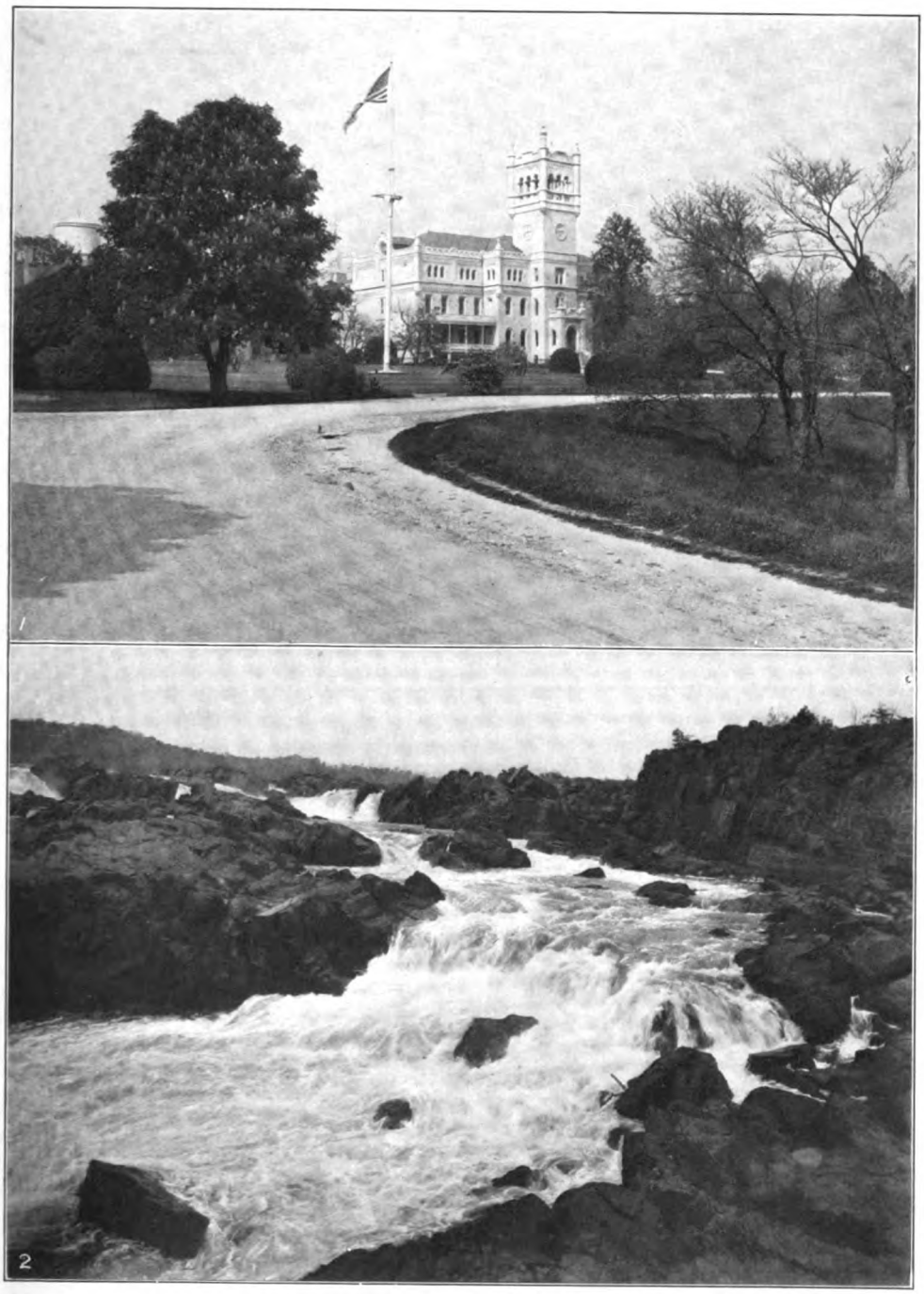
DISTRICT COURTS. See COURT.

DISTRICTS, Rural Administrative, the term applied to rural districts other than county, council, town, borough, village and school districts. These minor rural units include election, fire, water, health, road, poor and other districts. In general, they are unsatisfactory, involving crossing and recrossing of district lines and overlapping of authority. The principle of the circumscribed district has been used to restrict college students from voting in college towns. See COUNTY; COUNTY GOVERNMENT; MUNICIPAL GOVERNMENT.

DISTURBANCE, at common law, the offense of violating an incorporeal property right, such as a profit, or a public right in the land of another party. Such rights have no possession of right and are not protected by actions of trespass but by appropriate proceedings against a disturbance by the owner of the land. The forms of the offense are numerous, depending upon the nature of the right involved. See EASEMENT; NUISANCE; TRESPASS.

DISTURBANCE OF PUBLIC WORSHIP, a modern offense, defined by statute, which in America has superseded the common-law offense of brawling in church. It consists in any wilful interference, by word or deed,

DISTRICT OF COLUMBIA



1 Soldiers' Home

2 Falls of the Potomac

with the good order of persons assembled for religious worship. It may be committed by a person within the place of worship or by noisy conduct on the outside. It is a misdemeanor and is punished by fine or imprisonment, or both. See NUISANCE.

DISTYLE, in classic architecture, a composition showing two columns in front.

DISUSE. It is familiar knowledge that continued lack of use of any particular muscles in our body by any one of us tends to make these muscles flabby and weak; in a word, these disused muscles tend to degenerate. This is not only true of muscles but of many other tissues and organs, and is not only true of parts of our body, but of body parts of other animals.

It was largely on the basis of a knowledge of this fact, and of the other related one, that muscles and most other body parts which are much used become larger and better developed, and of an assumption as a further fact that these changes in the structure and functioning of the parts of an individual acquired during the individual's lifetime through use and disuse, are directly inherited by the offspring of the individual, that Lamarck founded his famous theory of evolution. See articles EVOLUTION, HISTORY OF and EVOLUTION, THEORIES OF.

Many animals that live in dark caves, or at great depths in the sea, or in underground burrows, have rudimentary eyes or no eyes at all, although their nearest relations above ground have well-developed eyes. Species or races of winged animals that have given up, or are giving up, flying, under conditions of domestication, where flying is no longer necessary, as in the case of the barnyard fowl and the moths of the silkworm, have degenerating wings. In man there is a host of rudimentary, or better, degenerating, organs, such as the vermiform appendix, the skin muscles of the scalp, the wisdom teeth, etc., whose functions are no longer necessary to us, and which are consequently in a state of developing backward toward total disappearance rather than forward toward better condition. Lamarck's explanation of this is that although these organs were useful to our ancestors of far remote times, they have gradually become less needed because of changing conditions, and hence have, through disuse and the inheritance of the degenerating effects of this disuse, come gradually to be rudimentary in the species. Occasionally an individual is met who can use the skin muscles of scalp or the muscles of his outer ears. He represents an ancestral condition.

Lamarck's explanation is simple: It is plausible. *But* it lacks an all-important element, and that is the proof of the assumption that characters or changes, acquired by an individual in his lifetime, due to use or disuse, or the influence of the environment, are actually inherited. As a matter of fact, this has not only not been proved, but has been apparently disproved. Darwin, who, many years after Lamarck's theory was offered, proposed another explanation to account for rudimentary or degenerating organs, accepted in some measure Lamarck's assumption of the inheritance of acquired characters. But the Neo-Darwinians, coming after Darwin, rejected Lamarck's assumption entirely, maintaining that there was no evidence to support it and much evidence against it. It was August Weismann, an eminent German evolutionist, who took the lead in the attack and final practical overthrow of Lamarck's evolution explanation in general and of his explanation of degenerating organs in particular.

The other principal explanation that has been offered of the presence in animal bodies of rudimentary organs and their increasing degeneration even to actual disappearance is included in Darwin's general explanation of evolution, namely his theory of natural selection, based upon a rigorous struggle for existence and survival of the fittest.

If an animal species, or a group of individuals of the species, begins to change its habits of life so as to render less important, or even comparatively useless, certain organs of the body, as by the adoption of a cave life which renders seeing a useless function, there will be no advantage to those individuals born with better eyes and no disadvantage to those born with poorer ones. Hence, there will be no selection in the struggle for existence as between these two kinds of individuals, and both kinds can persist and produce young like themselves; or they can mate together and produce young with poorer eyes than the better-eyed parent with no disadavantage to the species or part of the species in the caves. Thus a degeneration of eyes and eyesight may be initiated by this miscellaneous mating or *panmixia,* and may be continued even to a nearly or quite complete loss of eyes by continued *panmixia.*

It is even conceivable that in the case of certain organs no longer needed because of a change of habits of the species, the individuals retaining the organ in full size and development might be handicapped in the struggle for existence through the necessity of its being necessary to divert some of their food and air to the nutrition of these useless parts, while others born with the parts smaller or less developed would have a certain useless expenditure of nutrition on the unnecessary parts. These latter individuals might be assumed therefore to have a little advantage in the bitter struggle for existence by being able to use more of their food and oxygen for the other more important parts of the body.

This sounds rather far fetched, but it has been seriously proposed by extreme Darwinians, who assume that the struggle for existence is so rigorous that even the most minute advantage can turn the scale for or against any individual or species.

Herbert Spencer tried to reduce this position to an absurdity by taking as an example the tiny rudimentary bones of the whale's limbs. These bones are but a few inches long in a body that may be a hundred feet long, and of correspondingly enormous mass. How much food is saved to the whale, asks Spencer, that finds itself born with leg-bones a few millimeters shorter than those in another whale? Can anyone of sane mind conceive or admit of a life-and-death determining advantage in this minute difference in nutritive necessity?

So the situation to-day as regards a sufficient explanation of the actual evolutionary results of disuse and the actual causes of the degeneration in species of disused parts, resulting in so-called rudimentary or vestigial organs,

is far from satisfactory. We know that disuse of parts by any individual results in degeneration of such parts in the particular individual concerned, but how it can result in an inherited and increasing degeneration or loss of the parts throughout the species is not clear.

The proponents of the newest theory offered to explain evolution, the mutations theory, have no more satisfactory explanation of the results of disuse, as these results affect the species, than have those who cling to the older evolution theories. Their theory would simply explain the occasional sudden appearance of an individual, or of several individuals in any species, with any one or several organs in undeveloped or rudimentary condition, and this congenital character could be handed on by inheritance. But original use or disuse would have nothing to do with the sudden appearance of the new condition of the organ, nor would the new condition appear necessarily in an animal or species in which it would be an advantage.

Of all the explanations of the evolutionary results of disuse, the Lamarckian one is the simplest, the most rational and most plausible. But it can have no real standing until it can be proved that acquired characters, or certain categories of them, including the changes produced in the individual by disuse, can be handed down to the next generation by inheritance.

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DITCH. (1) A trench or fosse on the outside of a fortification or earthwork, serving as an obstacle to the assailant and furnishing earth (déblai) for the parapet (remblai). It is from 90 feet to 150 feet broad, in regular fortifications, and 10 to 12 feet deep below the natural level of the ground. The fosse around a Roman encampment was usually nine feet broad and seven feet deep; but if an attack was apprehended it was made 13 feet wide and 12 feet deep. The agger, or parapet, of the encampment was raised from the earth to the fosse, and was crowned with a row of sharp stakes. (2) In agriculture, a trench usually made along the sides of fields, so that all the drains may be led into it, or along the top of a field so as to divert surface water. Sometimes a double ditch is adopted, and a hedge planted between. In arable land, however, since the introduction of pipes, ditches have largely given place to underground drains.

DITCHFIELD, Peter Hampson, English author and clergyman: b. Westhoughton, Lancashire, 20 April 1854. He was educated at Oriel College, Oxford, entered the Anglican priesthood, and has been rector of Barkham, Berkshire, from 1886. He is a prolific writer, especially in the field of ecclesiastical and general antiquities; wrote in 10 volumes 'The National Churches Series' (1891–97); contributed the volumes on Buckinghamshire, Oxford, Kent, London, Lancashire and Cheshire to the 'Memorials of County History Series,' and acted as general editor.

DITHYRAMBUS, or DITHYRAMB, in Greek literature, a form of lyric or poem sung in honor of the god Dionysus (Bacchus) at his festivals. Since these festivals were celebrated with all the extravagance which would please the god of wine, the dithyrambs employed in his worship naturally breathed the same frenzy. The character of the dithyrambus therefore requires bold images and lofty periods. The more apparent disorder it contains, the more it partakes of the fire of intoxication, the better it sustains the true dithyrambic character. In the wild Phrygian music it was sung in choirs. Arion of Methymne, in the island of Lesbos, was the first to give a regular choral form to it, about 625 B.C. Lasos of Hermione is said to have been the first who introduced dithyrambic contests into the public games. It was out of the mournful dithyrambic songs — later introduced — that ancient Greek tragedy took its rise. The expression *dithyrambic poem* denotes, also, any lyric poem filled with a wild and impetuous enthusiasm, as is the case with many odes of Pindar. 'Alexander's Feast' by Dryden (1698) is the best example of the dithyramb in English.

DITMERS, Raymond Lee, American naturalist: b. Newark, N. J., 20 June 1876. He was graduated at the Barnard Military Academy in 1891. He spent five years as assistant curator of entomology at the American Museum of Natural History, was court reporter on the New York *Times* in 1898–99, and entered the New York Zoological Park as curator of reptiles in 1899, and since 1910 has been in charge of the department of mammals. He is a Fellow of the New York Zoological Society and corresponding member of the Zoological Society of London. He is author of 'Snakes Found within Fifty Miles of New York City'; 'The Reptile Book' (1907); Reptiles of the World' (1909), two valuable contributions in their fields; also numerous articles on entomology and herpetology.

DITMARSH, or DITMARSHES (Ger. *Dithmarschen*, "the German marshes"), a district of Holstein in Germany, along the German Ocean, between the mouths of the Elbe and the Eider, so little raised above the sea as to require the protection of strong embankments. Area, 531 square miles. Originally a part of Saxony, and from 1474–1559 practically an independent state, it became part of Holstein and Denmark, and in 1866 was annexed to Prussia. Pop. 96,373.

DITTANY (*Dictamnus*), a genus of plants belonging to the rue family (*Rutaceæ*). The members of this genus are beautiful plants, with alternate compound imparipinnate leaves. Their flowers are large and white or purplish in color. They are arranged in racemes, the peduncles and pedicels of which secrete in numerous more or less prominent glands the essential oil which gives these plants their odor. Their roots were formerly used in medicine; their flowers furnish the perfumer with a fragrant distilled water. The most common species is *Dictamnus albus*, the leaves of which greatly resemble those of the ash. It is said that in hot weather the odoriferous particles thrown off from this plant form an inflammable atmosphere around it: and if a lighted candle be brought near the plant, especially in a time of drought, there is a burst of flame around the plant. The dittany of the United States (*Cunila mariana*) belongs to the mint family (*Menthaceæ*) and is the only one of the 15 species of the genus native in America. It is an exceedingly aromatic herb,

with purple-pink flowers arrayed in loose clusters. It is found from New York to Florida and west to western Georgia and Ohio. The dittany of Crete is *Origanum dictamnus,* and the bastard dittany is a species of *Marrubium* (hoarhound), both labiates.

DITTE, dēt, **Alfred,** French chemist: b. Rennes (Isle-et-Vilaine), 20 Oct. 1843; d. 1908. He has made very extensive original investigations in chemistry. He has written extensively in magazines and reviews on a variety of scientific subjects which have received official recognition and commendation from the *Institute* of which he was elected member in 1897. He is a commander of the Legion of Honor and received numerous other decorations for his research work and discoveries in the physical sciences.

DITTENBERGER, Wilhelm, German classical scholar: b. Heidelberg, 1840. He received his education at Jena and Göttingen. In 1874 he became professor of classical philology at the University of Halle. He has published 'De Ephebis Atticis' (1863); 'Inscriptions Atticæ Ætatis Romanæ' (1878–82; Vol. III of the original edition of 'Corpus Inscriptionum Atticarum,' published by the Berlin Academy); 'Sylloge Inscriptionum Græcarum' (1883; 2d ed., 3 vols., 1898–1901); 'Corpus Inscriptionum Græcarum Græciæ Septentrionalis' (1892); 'Orientis Græci Inscriptiones Selectæ' (2 vols., Leipzig 1903–05). Consult Larfeld, 'Griechische Epigraphik' (Munich 1914).

DITTERS VON DITTERSDORF, Karl, German musical composer: b. Vienna, 2 Nov. 1739; d. 31 Oct. 1799. He was a brilliant violinist and accompanied Gluck to Italy in 1761. He is particularly distinguished in comic compositions and perhaps unrivaled in this branch of music among the German composers. Several of his operas were represented with great applause even in Italy: 'Doktor und Apotheker' (1786), which still holds the stage; 'Betrug durch Aberglauben'; and 'Die Liebe im Irrenhause,' were among the most successful of these. He also acquired considerable reputation by his oratorio 'Esther,' which secured his elevation to a place among the Austrian nobility. On his death-bed he dictated his autobiography to his son.

DITTON, Humphrey, English mathematician: b. Salisbury, 29 May 1675; d. 15 Oct. 1715. He was for a time a nonconformist clergyman. Through Sir Isaac Newton he received the appointment of mathematical master at Christ's Hospital, which appointment he retained till his death. In 1714, in conjunction with Whiston, he published a new method for finding the longitude at sea, as well as on land. He was the author of several mathematical works, the principal of which are the following: 'General Laws of Nature of Motion' (1705); 'Institution of Fluxions' (1706); 'Treatise of Perspective, Demonstrative and Practical' (1712); 'New Law of Fluids' (1714). He also wrote a 'Discourse Concerning the Resurrection of Jesus Christ' (1712), which was afterward translated into several languages.

DIU, dē'oo, an island of India, belonging to the Portuguese since A.D. 1535, off the south extremity of the peninsula of Kathiawar, in the Bombay presidency. Area, 20 square miles. On a point on the east end of the island is the fortified town of Diu, once an opulent city of 50,000 inhabitants, now dwindled to insignificance. Fishing is the chief employment of its inhabitants; it has a small but excellent harbor and a Jesuit's college, erected in 1601, now a cathedral. Pop. 14,614.

DIURETICS, drugs used to increase the elimination of urine. Such diuretics may be direct, in that they affect the renal epithelium, or indirect, in that they increase the blood pressure within the kidney and thus increase the urine elimination. This is largely an artificial classification, since it would seem that urine is always a true secretion and not a filtrate, and the renal epithelium must always be involved in the process of manufacture. Still it is a subdivision that has received wide recognition. Diuretics are frequently used in a number of heart, lung and kidney diseases; because in the normal elimination of urine certain catabolic products are cast off from the body in the urine. If they are retained, however, they give rise to various degrees of intoxication, which may be even fatal. Thus in certain heart diseases, either from insufficient pressure or from accompanying disease of the blood vessels, the elimination of the ordinary amount of urinary solids may be insufficient and result in poisoning. Hence diuretics, by increasing the elimination of urine, increases the output of these poisonous products. In all patients for whom diuretics are useful, certain concomitant drugs are of benefit, those namely that empty the bowels freely and those that increase the elimination of perspiration. Of the numerous diuretics the saline salts of potassium, sodium, lithium, calcium, magnesium, the heart tonics, such as digitalis, adonis, caffeine, strophanthus convallaria, theobromine, are most frequently employed. To this list calomel, copaiba, cubebs, juniper, oil of sandal and other irritating diuretics might be added. Injections of hot water into the rectum cause a pronounced diuresis, and this method is now recognized to be one of the best modes of inducing an increased elimination of urine.

DIVAN. (1) With the Turks it was for long the highest council of state; the Turkish ministry. Every pasha has also a divan. (2) In the large mansions of the rich in Turkey a divan signifies a large hall for the reception of visitors, which communicates with a number of ante-chambers surrounding it and which contains sofas placed round the walls, often adorned with costly tapestry and richly embroidered cushions. (3) Divan, with the Arabs, Persians and Turks, is used to denote a complete collection of lyric poems, which they call ghazals and through each of which one single rhyme extends: they never exceed the length of 14 strophes. Such a collection is complete if there are as many divisions as there are letters in the alphabet of the respective languages; and each division contains at least one poem, the rhymes of which terminate with the letter under which the division falls; some letters are excluded, as few or no words end in them. Goethe applied this name to a collection of poems by himself, written in the eastern fashion. (4) The word is also applied to a soft-cushioned seat for the accommodation of several persons.

DIVER, a name properly restricted in ornithology to birds of the family *Colymbidæ*, but applied with little discrimination to various other water-birds of similar habits. The compact, depressed body, powerful, posteriorly placed legs with fully webbed feet, the long sinuous neck and stout acute bill admirably adapt them for aquatic life and the pursuit of fish. They are strong flyers, but on the land are awkward and stand nearly upright. The plumage is peculiarly compact and resistant to water. Three species are well known in the United States. The greath northern diver or loon, *Urinator* (*Colymbus*) *imber*, is a large bird, sometimes attaining a length of three feet. Above the plumage is a lustrous black with green and purple metallic reflections and marked with numerous white spots and streaks; below, a nearly pure white. The loon is distributed throughout the entire northern hemisphere on both fresh and salt waters, and during the winter is found in all parts of the United States, in the northernmost of which it breeds, building its nest among the rushes near or in the water, and laying as a rule but two eggs. It winters from the southern limit of its breeding range to the Gulf of Mexico. The loon is best known by the extreme facility with which it dives at the flash of a gun, thus escaping injury while the ball speeds harmlessly overhead, and for its wild resonant cry, about which many traditions and myths have arisen. It can remain several minutes under water and swim 100 yards before rising to the surface for air.

The red-throated diver (*U. lumme* or *C. septentrionalis*) is eight or nine inches shorter than the loon, of a rusty black, with profuse small white spots above, white below, with a large distinct chestnut-colored patch on the lower part of the throat. It is distributed like the loon, but is rather more northern, and is found in the United States in the winter only. The black-throated diver (*U. arcticus*) is intermediate between the other two species, from which it is distinguished by a blue-black neck-patch. It is a high northern species and is represented within the limits of the United States chiefly by a western variety which occurs abundantly on the Pacific coast in winter. Consult Baird, Brown and Ridgway, 'Water Birds' (1884); Elliot, 'The Wild Fowl of the United States' (1898).

DIVES, dī'vēz (Lat. "rich"), the name popularly adopted from the Vulgate translation for the "rich man" in the parable of the rich man and Lazarus, Luke xvi.

DIVI-DIVI, dē'vē-dē'vē, **Libi-dibi**, or **Libidivi**, the astringent bean-pods of *Cæsalpinia coriaria*, a tree which grows in northern South America, in the Antilles and in Mexico, and a member of the family which yields sapan, brazil and other red woods. The pods are about one inch broad and three inches long, but are generally bent or curled up and tend to scale off on the outside. They have a pale-brown color with a tinge of yellow; sometimes they are spotted and black and then they are not so good. They are very rich in tannin (especially in the pod), good samples containing as much as 40 to 50 per cent and form one of the best tanning materials. They are largely used in calico-printing for blacks and dark shades.

DIVIDE, The Great, or THE CONTINENTAL DIVIDE, names given to an elevated ridge of land in the United States where occurs the parting of the waters which flow to the Atlantic and the Pacific oceans. The name, "The Great Divide," is now commonly applied to a broader extent of country than the Continental Divide or watershed proper. It comprises that region in Montana and Wyoming wherein so many of the large rivers of the United States have their source, and which possesses within itself nearly all the characteristics of a continent. The arrangement of the elevated land masses in relation to the valleys and plateaus is continental; the temperature and vegetation vary almost from that of the tropics to the frigid zones; its mineral wealth is enormous; and its wild animals and great varieties of fish make it the paradise of the hunter and the angler. Its waters flow to the Gulf, the Atlantic and the Pacific oceans, and streams rise on its eastern borderland whose waters flow to the Arctic Ocean. It is the natural geographical centre of North America. The term "Divide" is used, especially in North America, as synonymous with watershed.

DIVIDEND. (1) *In arithmetic*, a number to be divided by another; thus, if 20 is to be divided by 4, 20 is the dividend and 4 the divisor. (2) In commerce the fractional part of the assets of a bankrupt which is paid to the creditor in proportion to the amount of the debt which he has proved against the estate of the debtor. (3) The sum periodically paid as interest on loans, debentures, etc., or distributed as profit on the capital of a railway or other company. The sum to be divided is broken up into as many portions as there are bondholders or shareholders to claim them, and the fractional part falling to each holder bears the same proportion to the whole dividend as the amount of stock or shares he holds bears to the whole capital. Dividends cannot be paid out of the capital of a public company. Preference shares in a company are those entitled to a fixed rate of interest, the interest on which must be paid before the ordinary shareholders can get any return. The declaration of a dividend is one of the powers of directors, but must be confirmed by a meeting of shareholders. In England, dividends must be paid in cash; in the United States they not infrequently take the form of stock bonds or scrip. When the profits of a company are so large as to invite hostile comment on the part of that section of the public which it serves, an increase of nominal capital may be deemed politic and carried through by the issue of pro rata stock dividend.

DIVIDENDS. See CORPORATIONS, LEGAL.

DIVIDING ENGINE, a machine for marking fine lines at regular intervals by means of a diamond point or other sharp edge, on the scales of scientific, mathematical or other instruments, and also for dividing a length into aliquot parts as in the making of metre rods. Another use to which they are put is the making of diffraction gratings, in which a very great number of lines are cut exactly parallel and at very small intervals apart. Joseph von Fraunhofer was the first to make the instrument for ruling gratings, but others soon were made by Michelson, Rowland and Rutherford.

The same general principle, however, is found in all. The machine consists of a cylinder with a screw thread and its ends held in yokes, while it carries a large nut, which is held on ways parallel to the screw. When the screw is turned by a crank or otherwise, the nut advances or recedes. The cutting edge is set at a point above the screw so that it makes a line at right angles to the axis of the screw cylinder. The piece on whose surface the rulings are to be made is attached to the nut. A line is then made by the cutting edge; the cylinder is turned through a certain fraction of a complete revolution, thus carrying the nut and the surface forward a small distance, when a second line is ruled; and so on until the whole surface of the piece is marked. All modern machines are automatic and embody various refinements of design and construction. See SCREW and consult 'The Collected Papers of Henry A. Rowland' (Baltimore 1902), *Physical Review* (Vol. XXX, No. 4).

DIVIDING RANGE, Great, an Australian chain of mountains, forming the watershed between the rivers flowing into the Pacific and those running westward. It stretches from the north of Queensland to the south of New South Wales and westward through Victoria. The Darling River rises in the range.

DIVINA COMMEDIA, dē-vē'nā kŏm-mā'dē-a. See DANTE; DIVINE COMEDY.

DIVINATION (Lat. *divinatio*), the art or act of fortelling future events, or discovering things secret or obscure, by the aid of superior beings, or by other than human means. The derivation of the word indicates a belief that omens are sent by divine interposition. Natural divination was anciently thought to come by divine afflatus; artificial divination, by signs, omens, etc. At an early time divination formed a regular science, intimately allied with religion and furnished with rules and regulations. Even though divination did not have its origin in fraud, it became a fruitful source of imposition. Moses prohibited divination expressly (Deut. xviii, 11). Saul expelled "those that had familiar spirits, and the wizards," from his kingdom; yet he was weak enough to consult the famous witch of Endor shortly before the battle in which he fell. The Egyptians and Greeks had their oracles. With the Romans divination and witchcraft were brought into a kind of system, and constituted part of their religion. (See AUGURIES and AUSPICES). The ancient Germans had consecrated white horses, from whose snorting and neighing they drew favorable or unfavorable signs. They also followed the guidance of prophetesses, whom they called *Alrunes*. Many Christians, from the period of the 3d century, adopted the *sortes biblicæ* or *sortes sanctorum* — a mode of judging of the future by opening the Scriptures at random, and forming an opinion from the passage on which the eye happened to fall. (See BIBLIOMANCY). In early times Virgil's Æneid was also used for the same purpose (*sortes Virgilianæ*). All the ancient Asiatic tribes had modes of divination; and sorcerers are common among the Indians of America. Many of the old forms of divination continue to be practised in Christian nations at the present day, sometimes from superstition, sometimes for amusement, gypsy fortune-tellers being often resorted to. There are many names for the different modes of prognosticating the future by means of the various appearances which nature and art present, from the revolutions of the stars down to the grounds of a coffee-cup. The following by no means exhaust the list, as the different modes of divination that have been practised are almost endless: Aëromancy, divination by air; aleuromancy, by flour; arithmomancy, by numbers; bibliomancy, by the Bible; capnomancy, by smoke; catoptromancy, by mirrors; cheiromancy, by the palm; cleidomancy, by keys; ciromancy, by wax; geomancy, by the earth; hepatoscopy, by the liver of animals; hydromancy, by water; lampadomancy, by lamps; necromancy, by corpses; nephelomancy, by clouds; oneiromancy, by dreams; pyromancy, by fire; rhabdomancy, by rods. The works on this subject are very numerous, including the mystical productions of the East, the Cabala (q.v.)), the treatises on astrology, witchcraft, etc., in the Middle Ages, and the studies of more recent writers. See ASTROLOGY; BLACK ART; CUP, DIVINATION BY CLAIRVOYANCE; ORACLE; PALMISTRY; WITCHCRAFT.

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DIVINE COMEDY, The. When Dante was nine years old he for the first time saw Beatrice, the daughter of Messer Folco Portinari and Madonna Gilla Caponsacchi. She was his junior by one year; and Boccaccio says that he "received her fair image into his heart with such affection that from that day forth as long as he lived it never left him." Nine years elapsed before she spoke to him again, although he tried many times to see her. It is believed that she was married, while still a young girl, to Messer Simone de Bardi. She died in June, 1290, in her 23d year, and Dante was inconsolable. In memory of her, that "blessed Beatrice, who lived in heaven with the angels and on earth with his soul," he wrote, 'La Vita Nuova' (The New Life), which is a mystical account of his passion, interspersed with many sonnets and canzoni, he having, as he says, discovered "the art of saying words in rime." The book ends with this sentence: "To me appeared a wonderful vision, wherein I saw things which made me resolve to say no more of this Blessed One until I could more worthily descant upon her. And to attain this, I study to the utmost of my powers, as she truly

knows; so that, if it shall be pleasing to Him through whom all things live, that my life shall be prolonged for some years, I hope to say of her what has never been said of any other woman." The work to which he thus promised to dedicate his life was 'La Divina Commedia.' He himself called it simply "The Comedy," the epithet "Divine" not having been applied to the poem until 1555, in an edition brought out by Dolce. In the text it is mentioned as "il sacro poema". Dante, in a letter to Can Grande della Scala, says: "The title of the book is, 'Here begins the Comedy of Dante Alighieri, Florentine by birth not by character.' To understand this one must know that "Comedia," derived from *comus* (village) and *oda* (*song*) means about the same as village-song. And Comedy is a sort of poetic narrative, different from any other. As regards its matter, it differs from tragedy, since the latter is at first pleasing and quiet; at the end, foul and horrible. . . . Whereas comedy begins with some degree of adversity but ends prosperously. . . . In the same way tragedy and comedy differ in style: the one being lofty and sublime, the other unstudied and popular. . . . Whence it is evident why this work is called a Comedy: for if one regard the matter thereof it is at first horrible and foul, being in Hell; at the end it is prosperous, desirable and grateful, since it is in Paradise. If one regard the style, it is unstudied and popular, because it is in the vernacular, in which even ordinary women speak to one another." He was indeed, for a time, criticized for not having composed it in Latin, which during the Middle Ages was the polite language.

Like many of the other great works of literature it may be interpreted in two ways: its protagonist may be conceived as either Dante himself, or as the human soul, the type of sinful man. This protagonist struggles first unaided to escape from the dangers of a wild, tangled and frightful forest and to climb the mountain of virtue, or of salvation, which he is prevented from doing by three symbolic wild beasts — a nimble-footed, sly panther, a lion with head held high and ravenously hungry, and a lean, fierce wolf. He retreats into the depths of the forest and there becomes aware of one who "by reason of long silence seemed feeble." It is the shade of Virgil come to show him the right way to escape the wild beasts and to attain to "the delectable mountain, which is the beginning and the source of all joy." There are several ways of interpreting the symbolism of this introductory canto. The obscure forest in which Dante, "in the midst of the road of this our life" (that is, when he has just reached the age of 35) in May 1365 — has wandered in sleep is the world, or sin. The panther is "luxury," "dissolute pleasure," "incontinent appetite," or, with a political significance, is the city of Florence, which had persecuted the poet, condemning him to death, with confiscation of his property, because as a Ghibelline he favored the Emperor and not the Pope. The lion is "pride" or "bestial violence," or may be regarded as France. The greedy wolf taken subjectively is "avarice," "greed," "materialism"; taken objectively it may refer to Dante's enemies, the Neri (the Guelfs or Black party); or, taken politically, it may mean Rome. Dante himself gives no clue to this symbolism, but leaves it to the reader to interpret. Virgil typifies Man's Reason, and therefore Dante hails him in a double sense as his "Teacher and Leader," the poet from whom he has acquired the beautiful style which has brought him fame. Virgil promises to conduct him through the eternal place where he will hear groans of despair, where he will see the spirits in torment. Then they will ascend to the place of those that are content to dwell in fire, because they hope, after purification, to attain the joys of the Blessed. Having had experiences of Hell and Purgatory, Dante, still in the flesh, will be admitted to Paradise, there to be guided by a spirit more worthy, since Virgil (or Human Reason) had not been obedient to the laws of that Emperor who reigns over the universe. This more worthy spirit is Beatrice, typifying Man's spiritual Nature, the functions of which are Faith, Hope and Love. Dante, after some demur, is encouraged to follow, and with fear and trembling, begins the descent into the Inferno. Over the gate is the famous inscription which ends with the words, "Leave all hope behind ye who enter here." Hell is divided into nine ever-narrowing circles, the last, at the centre of the earth, a place where, surrounded by a fourfold ring of ice, Lucifer crushes in his three mouths Judas, Brutus and Cassius, the three arch-traitors of history. In the circles and their subdivisions all varieties of the seven cardinal sins still continue under the inevitable punishments inherent in them. They are inflicted by the symbolical creatures of Greek mythology — Charon, Minos, Cerberus, the Centaurs, the Harpies and by the devils and other beings created by mediæval theology, or else they are represented by physical analogies, such as fire, mud, filth, worms, pitch, ice. Dante departed from the conception of Hell as depicted by his great contemporary, Thomas Aquinas, for he gives the sinners that had died in their sins, unrepentant, no room for remorse: lost souls, according to Dante's psychology, will to continue in the horrible state which they had chosen, while still alive, as their earthly environment; they have no wish to escape; and so forever suffer in the whirlwind of passion and lust, the mud and mire of gluttony, the falling flakes of flame and the desert sands of atheism, the cannibalism of treachery, the never-melting ice of the traitor. He lavishes all the awful symbolism of the Church to express the agony and hopelessness of Hell, and to each place he consigns with sardonic partisanship those that had been his personal or political enemies — popes and poets and teachers: a bitter revenge, unrelenting and horrible. At the vestibule of the Inferno he places Limbo where dwell those that had lived virtuous lives, such as Virgil himself, but without knowledge of Christianity. Here Dante is met by four tall shades: Homer, the sovereign poet; Horace, the satirist; Ovid, who sang of the ancient mythology; and Lucan, the poet of the Pharsalia, forming the School of that Lord of most lofty Song, "who soars above all as an eagle flies." They salute him and with marks of honor accept him as the sixth of their august company. Here too he sees many folk with slow, grave eyes, of great authority. Among them he recognizes the heroes and worthies of pre-Christian days, philosophers and historians; they experience in this underworld desire without hope but are not unhappy or subject to other punishment. In the

Fifth Canto of the Inferno occurs the famous episode of Paolo and Francesca, occupying more than half of it — 69 lines — and since expanded by poets and dramatists, in many forms. The lines, «There is no greater woe than in misery remembering the happy time,» is an almost literal translation from a Latin apothegm of Boethius. Dante here shows his sympathy with the sinners who died without chance for repentance, because their sin grew out of genuine love. He never shows sympathy where a sin was due to meanness or ill-will.

The material removed from the earth to make room for Hell was heaped up to form the Mountain of Purgatory, situated like an island in the ocean which, according to his cosmography, forms the under side of the earth. It is exactly antipodal to Jerusalem. Like the Hell, it consists of nine divisions. The first is the Ante-Purgatory where souls that had repented late were compelled to sojourn 30 times as long as they had been in a state of unrepentance. Here is the Valley of the Princes — rulers that had been negligent of salvation. Then come seven ever narrowing circles or ledges where the seven cardinal sins are purged. At the Fifth Ledge, Statius, the poet of the 'Thebaid,' who happened to have been born and to have died in the first century of the Christian era, meets the two other poets and accompanies them, engaging them in charming conversation. On the top of the mountain is situated the Earthly Paradise. Here Virgil suddenly disappears, declaring that henceforth his pupil's will is free, upright and sane; henceforth he cannot go astray even though he follow his own impulses. In other words, Human Reason must give place to Divine guidance. There follows a scene of exquisite mystical symbolism. Beatrice appears and Dante confesses his dereliction from the Faith and is made to pass through the River Lethe, and to drink of it, whereby he forgets all his evil past; then he enters the River Eunoë, «whereby henceforth he will remember only what is good, and is ready to mount with his new guide into Paradise. In the 'Purgatory,' as in the 'Hell,' Dante departs from the teaching of Thomas Aquinas. Here repentant sinners have no desire to escape from the purging fire; they rather throw themselves upon it, without regret, exult in it, realizing its efficacy in purifying them; they cherish hope and have no fear.

The Paradise is also divided into nine spheres. According to Dante's cosmography the seven great planets revolve around the earth. With Beatrice he ascends in swift flight, first to the Sphere of Fire, pausing for a brief visit on the Moon, which is the abiding-place of those that were, by no fault of theirs, constrained to break their vows; thence to Mercury, to Venus, to the Sun, to Mars, to Jupiter, to Saturn, to the Starry Empyrean, to the Primum Mobile — the Crystalline Heaven, where around a point of dazzling light, symbolizing God, revolves a rainbow ring in turn composed of nine orders: Seraphim, Cherubim, Thrones, Dominions, Virtues, Powers, Principalities, Archangels and Angels, in the sequence supposed to have been declared by Saint Paul, when he was snatched up into the highest heavens.

Dante and Beatrice are now about 6,000 miles above the earth, according to his calculation, and have one more ascent to make — to the Empyrean, which is pure light. Here Beatrice is taken from him, and in her place appears Saint Bernard who bids him look upward. There he beholds the Celestial Vision: the Holy Virgin amid thousands of jubilant angels with wings outspread, the hierarchy, including Beatrice, who is seated just below the ancient Rachel, who is her counterpart in the Old Testament régime, making a Sacred Rose, the circle divided into two parts, one consisting of the Saints of the ancient dispensation and of course complete, the other, as yet unfilled, the place of those who believed that Christ had already come. Even in these supernal realms Dante does not forget his mundane politics: he finds in the Empyrean a place for Emperor Henry VII, who was to bring about perpetual peace on earth, while he consigns to the third pit or den of the Eighth Circle of Hell the treacherous Pope, Clement V.

Throughout the three canticles are found multitudes of striking episodes, vivid descriptions, now realistic and revolting, now exquisite and beatific, discussions of philosophical, theological and political topics, cameoed bits of history and biography, innumerable similes, often much elaborated; together, a vast array of recondite learning. Much of it is obscure, requiring in order to understand its meaning, an acquaintance with the history of Dante's time, with the mythology of antiquity, with the symbolism of mediæval theology, with the works of the Church Fathers, particularly of Saint Thomas Aquinas, with the details of Dante's own life, his friends and enemies, with the geography of that Italy through which he wandered in exile, going «up and down others' stairs,» eating «the bread that savors of salt.» Dante takes great pains to keep exact account of the time spent in his Dream — for it is a Dream, as he intimates in the 32d Canto of the 'Paradise.' It begins on the evening before Good Friday, 24–25 March 1300. The First Canticle occupies four nights and three days; the Second the same; Friday and Saturday are devoted to the marvels of the Nine Movable Heavens, and the poem ends on the 10th day.

The 'Comedy,' while having the triple aspect of a political tract, a theological study of the Fate of Man and a personal relation, is above all a great work of art. It consists of three canticles each of 33 cantos, though the first has one extra as a general introduction, making the full number 100, that being the square of 10, which, according to Dante, is the perfect number. The 'Inferno' has 4,720 lines, the 'Purgatorio' 4,755, the 'Paradiso' 4,758, a total of 14,233. The shortest of the hundred cantos have 115 lines each; the longest has 160. Each canto begins and ends with an alternate couplet; all the rest of the rimes are triple: hence the verse is called terza rima. To the 400 couplets and 4,611 terzine there are allotted 653 different rime-endings: some are used only once, others occur repeatedly, as *andо*, 39 times; *ante*, 45 times; *ore* (amore, love), 37 times; *io*, 47 times. Yet though there are only between six and seven new ones to a canto, the general effect is rich and musical. The great majority of the rimes are feminine (dissyllabic), but there are 14 instances of masculine rimes in *on*, *or* and *oth* (Sabaoth) or in vowels, *e*, *i*, *o* and *u*; there are 52 cases of versi sdruccioli (trisyllabic or dactyllic rimes). Each of the three canticles

ends with the word *stelle,* stars. Dante sometimes invented words, and his skill in managing the difficult metre was extraordinary. At the end of the 28th canto of the 'Paradiso' are eight lines in Provençal. There are a number of complete lines in Latin.

Whether Dante knew Greek is uncertain. He was familiar with Platonism and Neo-Platonism, and with the doctrines of Aristotle, which had come into Italy through the works of Avicenna and Averrhoes. Many others before him had imagined the arcana of the world beyond the grave; from the Bible he knew the story of the 'Witch of Endor,' the visions of Isaiah and Ezekiel, the Revelation of Saint John; and besides the descriptions in the ninth book of the 'Odyssey' and the sixth book of 'The Æneid,' he had as examples which he far excelled, many mediæval legends: 'The Vision of Saint Paul,' 'The Voyage of Saint Brendan,' 'The Vision of Tunalus,' 'The Purgatory of Saint Patrick,' 'The Vision of Fra Albertico,' 'The Vision of Wettin' and the 'Alberici Visio.'

He conceived the plan of the 'Comedy' in early manhood; it is supposed that he wrote seven cantos of the 'Inferno' before he was banished from Florence. Whether he incorporated that portion in his work is not known; but he must have begun it anew. It was probably finished before 1314, for in the 13th canto of the 'Paradiso' Henry VII had not as yet taken his place amid the throng that formed the Sempiternal Rose, and Pope Clement V was still alive.

After Dante's death the 'Comedy' almost immediately became widely known in manuscript copies, but the original has never as yet been found, to settle many disputed readings. Within 50 years, Florence, which had never allowed the poet to return, and 20 years after he was buried at Ravenna had stigmatized him as a rebel, established a chair for the study of his works, the first incumbent being Boccaccio. Nearly all the other Italian cities did the same. After the invention of printing there were many editions of the 'Divine Comedy.' There are four of the 15th century; those printed by Aldus in 1502 and 1515 are generally taken as the basis of the modern texts. Those of the Giuntina and of the Della Crusca, in the 16th century, are valuable. In the next century only three were issued. In the first 80 years of the 19th century 250 different editions appeared. The whole number is at the present time not far from 400. Many of them have been illustrated, beginning with the Florentine edition of 1481. Among great artists who engaged in this labor were Botticelli, Michelangelo, Federigo Zuocaro and Giovanni Strada, Bernadino Pocetti, John Flaxman, Peter van Cornelius, Karl Vogel von Vogelstein, Francesco Scaramuzza and Gustave Doré. Doré's coarse and ill-drawn pictures have had a vogue far beyond their merits. Parts of the poem have been set to music, as for instance, the Francesca da Rimini episode by Rossini and also by several other composers; the first lines of the 'Purgatorio' by Robert Schumann; those of the ninth canto by Girolamo Alessandro Biaggi. A monk, Matteo Ronto, a contemporary of Dante's, translated the whole work, line for line, into Latin hexameters. In the 15th century it was translated into Catalan and Provençal. There are nearly 50 German versions, one of the best is by King Johann of Saxony ("Philalethes," 1877). It may be read in more than 20 other languages and dialects, including Hebrew and Russian. Chaucer was the first to translate parts of the poem into English. Milton versified a few lines. The Rev. Henry Boyd in 1802 published the first complete English version. He was followed by the Rev. Henry Frances Cary, whose blank verse paraphrase is well known. In 1820 Lord Byron translated the Paolo and Francesca episode in terza rima. In 1867 Longfellow brought out his unrimed translation, which seeks variety by the use of the feminine endings at regular intervals. Some of his interpretations of it are incorrect, and he was often misled by fancied resemblances between Italian and English words; but it had great success. Dr. Thomas W. Parsons made the study and translation of the 'Comedy' his life work. He published the 'Inferno' in 1857, other portions at intervals, and the whole was issued after his death in 1893. The latest metrical version, like Cary's in blank verse, is by Professor Courtney Langdon of Brown University. The version runs line for line, facing the latest revised Italian text, and it is provided with a commentary, in which the translator embodies his life-long familiarity with Italian and study of Dante; the 'Inferno' came out in 1918. John Carlyle, brother of Thomas, translated the 'Inferno' in 1855 into English prose; with the continuation by A. J. Butler, also accompanied by the Italian text; this edition is useful. Charles Eliot Norton's careful prose version in three volumes with explanatory notes was brought out in 1893. For a good text edition, with bibliography, consult 'La Divina Commedia,' edited by Charles H. Grandgent (Boston 1909–13). There are hundreds of lexicons, commentaries and other aids to the understanding of Dante, published in all languages, beginning in 1328 with that of Jacopo della Lana. We may mention the latest 'La Divina Commedia di Dante Alighieri, Riveduta nel testo e commentata da Giovanni A. Scartazzini' (Leipzig 1874–82). Scartazzini's convenient 'Handbook to Dante' was translated by Thomas Davidson and published with corrective notes and many additions (Boston 1887). Koch's 'Dante Catalogue' (Ithaca 1900) contains a thorough critical bibliography up to that date.

NATHAN HASKELL DOLE.

DIVINE OFFICE, the services of the canonical hours. See OFFICE, DIVINE.

DIVINE RIGHT, the doctrine that the right of sovereigns to rule is derived immediately from the Deity, whose representatives they are, and that accordingly they are not responsible to their subjects for their method of governing, nor to any other human court of appeal. The English Royalists, among whom were Hobbes, Salmasius and Sir Robert Filmer, maintained that as the immediate representative of the Deity, all power and government were vested in the king, who "could do no wrong." The Parliamentarians contended that the exercise of political power sprang from the will of the people, by what was termed "the social contract." Milton, Algernon Sidney and Harrington were among the chief opponents of divine right. This was the doctrine to which the Stuarts were so much attached and which

was taught almost universally by the clergy of the Church of England and in the universities after the Restoration. Even the tyranny of James II was not enough to induce the English clergy to renounce this favorite doctrine, and after the revolution about 400 of them, including some of the bishops, sacrificed their benefices rather than forsake their principles in the matter. After this time the theory of divine right and passive obedience was little more heard of in England. In France the doctrine was upheld by many and was revived in the discussions which caused the Revolution. William II of Germany has frequently proclaimed in public addresses his belief that he is ruler of Germany by divine right.

DIVING, plunging into water and remaining submerged for greater or less periods of time, with or without communication with the atmospheric air. Diving without the aid of some artificial means to supply the diver with air under water is now rarely practised (unless for amusement) except in sponge, coral and pearl fishing, and sometimes for recovering treasure from wrecked vessels. The best divers are able to remain about one minute and a third under water, and only in extreme and exceptional cases as long as two minutes. Instances are recorded of divers remaining four, five and even six minutes under water, but these are of questionable authenticity.

To enable divers to remain for a considerable time (sometimes five or six hours) under water a diving dress has been used, which is so contrived that the diver is constantly supplied with air from above. It consists of a waterproof dress, to which is attached a neck-piece or breast-plate fitted with a segmental screw bayonet joint to which the head-piece or helmet, the neck of which has a corresponding screw, can be attached or removed by one-eighth of a turn. Air is supplied by means of a flexible tube, which enters the helmet and communicates with an air-pump. To allow of the escape of the used air there is another flexible tube which is led from the back part of the helmet to the surface of the water. There is a signal line attached to the diving dress, by which the diver communicates with the attendants, and he carries another line in his hand to guide him in returning to the rope or ladder by which he descends.

The helmet of the diving dress is usually made of tinned copper. There are several different types with special arrangement of valves for the air supply and exhaust. There are three windows in the head-piece, one-half inch thick glass secured in brass frames, the inlet valve in the helmet is non-return and is very important, as in the event of the air pipe being broken the valve closes and the diver is given a short time to realize his danger and act for safety. The breastplate and corselet are also carefully designed; they join the helmet to the body dress and preserve the air-tightness of the whole. It is necessary to add weight to the diver to overcome the too great buoyancy which otherwise would cause him to rise to the surface or prevent his descent, due to his displacement. The cuffs at the wrists are made secure by vulcanized rubber rings. The air-connecting pipes from the pumps to the diver are so made and arranged that the least inconvenience due to weight will be experienced by them. The boots are of stout leather with wooden soles and lead over soles. Electric lamps and telephones are provided, so that not only has the diver the best means of seeing around him but can communicate with those above him regarding his operations and be communicated with.

A diving apparatus now in use makes the diver independent of any connection with persons above the water. A strong metallic air reservoir of steel is carried on the diver's back. A respiratory tube issues from the chamber and is terminated by a mouth-piece which is held between his lips and teeth. This tube is furnished with a valve which permits the expulsion of air, but opposes the entrance of water. When the diver wishes to leave the water he inflates his dress with air from his reservoir and immediately rises to the surface. The greatest depth, and the pressure consequent upon it, which has been found safe for a diver of experience and of good physique to descend to, is 35 fathoms, the pressure being about 100 pounds. The pressure on the outside of the diver's dress due to the head of water is counterbalanced in the inside by the air pressure delivered by the air pump. Consult Boycott, 'Compressed Air Work and Diving' (London 1909); Dunville-Fife, 'Submarine Engineering of To-day' (London and Philadelphia 1914); British Admiralty 'Report of the Committee on Deep-Water Diving' (London 1907); Siebe, Gorman & Company, 'Diving Apparatus,' with notes and tables for the guidance of those conducting diving operations (London 1916).

DIVING BEETLE, an aquatic beetle of the family *Dytiscidæ*. It is flat, oval, with thread-like antennæ, is brown-black in color and sometimes has yellow markings. It is predacious, feeding on other insects, worms and even small fish. These beetles fly at night with great ease. The eggs are laid in water and the larvæ are termed water tigers. The larvæ are transformed in a cell in the earth. There are about 300 known species and in America the two commonest genera found are *Cybister* and *Dytiscus*. Consult Miall, 'Natural History of Aquatic Insects' (London 1903).

DIVING-BELL, a device by which work may be carried on under water with a full supply of atmospheric air. To illustrate the principle of this machine take a glass tumbler, plunge it into water with the mouth perpendicularly downward; it will be found that very little water will rise into the tumbler, but as air is compressible, it could not entirely exclude the water, which by its pressure condensed the air a little. The first diving-bell we read of in Europe was tried at Cadiz by two Greeks in the presence of the Emperor Charles V. The first of any note was made by Dr. Halley. The diving-bell is most commonly made in the form of a truncated cone, the smaller end being closed and the larger one open. It is so suspended that it may sink full of air, with its open base downward. As a diving bell of the ordinary construction is open to the objection of not being easily moved about, an ingenious kind of diving-bell, called a *nautilus*, has been invented, which is not open to this objection, but which is entirely at the command of the occupants, who can make it sink or swim and

move it about at pleasure, and can use it at the same time to raise great weights and convey them to any desired spot. (See DIVING; NAUTILUS). For an account of early diving-bells and apparatus consult Gerland and Traumüller, 'Geschichte der physikalischen Experimentierkunst' (Leipzig 1893).

DIVINING ROD, a forked branch or rod, generally of witch hazel, or some other wood, though sometimes of metal, by means of which the presence of underground water, minerals, treasure, etc., can be detected by certain gifted persons. When carried by these "diviners," the rod is grasped by the two extremities of the fork, and the tip or joint is declared to dip downward, in most cases, though in France it turns upward, when directly over the place of concealment of the substance sought. Although the idea has been held up to ridicule, belief in it persists, and the activities of the divining rod and its bearers have received the attention of eminent scientists. In France an extensive series of tests were made in January and February 1913, with three noted diviners. The results, so far as they could be verified, showed a complete failure to discover underground water. On the other hand at a convention of 345 members of a German society for the study of the divining rod, held in Halle, Germany, in September 1913, the consensus of the meeting was that the scientific value of the divining rod had been thoroughly established, even to the location of unseen deposits of potash; and a report was issued claiming success in between 70 and 80 per cent of various locations with the rod in German South Africa. The only explanation offered by scientific men is that the phenomena of the divining rod depend on an abnormal psychological condition in the diviner, analogous to clairvoyancy.

DIVISCH, dē'vish, **Procopius**, physicist: b. Senftenberg, Bohemia, 26 March 1698; d. Prenditz, Moravia, 21 Dec. 1765. He studied at the gymnasium at Znaym and at the cloister school of the Premonstratensians at Bruck in Styria. In 1726 he was ordained and changed his name, Wenceslaus, to Procopius. He became professor of philosophy at the school soon after. He devoted his attention mainly to physics. In 1733 he received his doctor's degree in theology at Salzburg. He became parish priest at Prenditz near Znaym in 1736. He devoted himself to hydraulics and electricity, and was called to Vienna to repeat his experiments at court. He applied electricity to medicine, constructed the first lightning rod, meeting much opposition on account of his proposal to render the practice of erecting lightning rods universal, and invented a peculiar musical instrument which he called the "denydor." He published 'Tractatus de Dei unitate sub inscriptione A et Ω' (Salzburg 1733); 'Theoretischer Tractat über die längst verlangte Theorie von der metrologischen Electricität' (Tübingen 1765).

DIVISIBILITY, the capability of being separated into parts. A metaphysical problem, long discussed by philosophers on abstract principles, is the divisibility of matter. The microscope reveals only to an infinitely small extent the subdivision of substances and tissues, organic and inorganic. Even in the mechanical productions of art distinctness of subdivision is amazing. A slip of ivory, of an inch in length, has frequently a hundred equal parts marked on it, all being distinctly visible. Nobert, a Pomeranian optical instrument maker, is renowned for producing the finest rulings on glass which have hitherto been executed. These test plates, as they are called, contain a number of bands, the coarsest of which in his 20-band plate contains 11,259 spaces to the inch, and the finest 225,187. Yarn has been spun so fine that one pound of it extended 4,770 miles.

The gold-beaters begin with a ribbon an inch broad and 150 inches long, which has been reduced by passing through rollers, to about the 800th part of an inch in thickness. This ribbon is cut into squares, which are disposed between leaves of vellum, and beaten by a heavy hammer till they acquire a breadth of more than three inches, and are therefore extended 10 times. These are again quartered, and placed between the folds of gold-beaters' skin and stretched out, by the operation of a lighter hammer, to the breadth of five inches. There seems almost no limit to the gold-beater's skill in dividing his tissue of gold, for one grain of gold has been beaten out to a surface of 52 square inches, and leaves have been made 367,500 of which would go to the inch. Iron, the least malleable of the above-mentioned metals, has been reduced to wonderfully thin sheets. Fine tissue paper is about the 1,200th part of an inch in thickness, but at the exhibition of 1851 Gillott, the steel penmaker, exhibited rolled sheets of iron the 1,800th part of an inch in thickness. Since then a sheet has been produced with an area of 55 inches, weighing but 20 grains and having a thickness of 1-4800th part of an inch.

It has been asserted that wires of pure gold can be drawn of only the 4,000th part of an inch in diameter. But Dr. Wollaston, by an ingenious invention, obtained wires of platinum much finer than this, some of them only the 30,000th part of an inch in diameter. Such excessive fineness is hardly surpassed by the filamentous productions of nature. Human hair varies in thickness from the 250th to the 600th part of an inch. The fibre of the coarsest wool is about the 500th part of an inch in diameter, and that of the finest only the 1,500th part. The silk line, as spun by the worm, is about the 5,000th part of an inch thick; but a spider's line is perhaps six times finer, or only the 30,000th part of an inch in diameter; insomuch that a single pound of this attenuated substance might be sufficient to encompass our globe. A single grain of sulphate of copper will communicate a fine azure tint to five gallons of water. Odors are capable of a much wider diffusion. A single grain of musk has been known to perfume a large room for the space of 20 years. Some germs are almost inconceivably minute. Thus the germ known as *micrococcus* is a minute spherical body sometimes no greater in diameter than the 32,000th of an inch. The minute organisms to which the name of *bacteria* is specially applied are rod-shaped bodies about 1,000th of an inch in length. Many of the so-called infusorial animalcules are so exceedingly small that myriads of them may exist in a drop of water.

DIVISION, *in mathematics*, the dividing of a number so as to discover how many times a lesser number is contained in it; one of the four

fundamental rules of arithmetic. The number to be divided is the dividend, the number which divides is the divisor, and the result of the division is the quotient. Division is the converse of multiplication. See ARITHMETIC.

In military matters the section of an army consisting of two or more brigades, composed of the various arms of the service, and commanded by a general officer. (See ARMY ORGANIZATION.) In the navy, a select number of ships in a fleet or squadron of men-of-war. *In deliberative legislation* the mode of determining a question at the end of a debate. In the House of Representatives at Washington, a division has no traditional formalities, being determined by the rules of the body itself. In the Senate a division is accomplished by a roll call. In the British House of Commons the speaker puts the question and declares whether in his opinion the "ayes" or the "noes" have it. Should his opinion not be acquiesced in by the minority, the house is cleared and the "ayes" directed to go into the right lobby and the "noes" into the left, where they are counted by two tellers appointed for each party. In the House of Lords the two sides in a division are called "contents" and "not-contents." *In logic* the act of distributing all the objects included in the denotation of a concept into mutually exclusive classes, each of which is marked off from the others by possessing some distinctive attribute. See LOGIC.

DIVISION OF ACCOUNTS AND DISBURSEMENTS, The. See AGRICULTURE, DEPARTMENT OF.

DIVISION OF LABOR, *in economics,* a theory based on the principle that industry can be best carried on when each man has a special work to do. Constant practice in doing the same thing leads to a perfection which could not otherwise be attained. The classical illustration of it in the history of political economy is that of pin-making as given by Adam Smith: "One man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on is a peculiar business; to whiten the pin is another; it is even a trade by itself to put them into a paper; and the important business of making a pin is in this manner divided into above 18 distinct operations, which in some manufactories are all performed by distinct hands." In this way 10 men could make about 48,000 pins in a day, whereas, if they worked separately and independently, they certainly could not each of them have made 20, perhaps not one pin in a day. Adam Smith offers the following reasons why the division of labor secures greater efficiency: "First, the increase of dexterity in every particular workman; secondly, the saving of the time which is commonly lost in passing from one species of work to another; and lastly, the invention of a great number of machines which facilitate and abridge labor and enable one man to do the work of many." Economists believe, however, that Smith has laid too great stress on both the second and third of the above reasons. Later writers have extended the term to include the separation of employments as well as the processes or operations in one employment. The fact that one man is exclusively a bricklayer and another exclusively a carpenter increases their combined production over what it would be were they not each confined to one trade. The great advantage of division of labor lies in the saving of labor and of time. By devoting himself exclusively to one operation a workman acquires a high degree of skill in that operation, makes a better use of material, thus preventing waste, and the continuity at one operation saves the time which would otherwise be spent in passing from one process to another. Another advantage is the stimulus given to invention by the concentration of energies upon distinct and definite processes. Similar advantages result from the differentiation of functions among the people generally, by specialization not only in factories and in trade and commerce, but even in professional and scientific activities. The disadvantages urged against the system are that extreme specialization is harmful to the intelligence, saps the vitality of the operator and produces workmen who through any industrial upheaval, being capable of doing only one thing, would find themselves without a place and a living. While there may be some truth in such a presentation, it is an extreme one, and is rebutted by the fact that the mechanical operations of factories are not so widely dissimilar as to preclude a man, displaced from one type from securing suitable employment in another. In addition it may be noted that through the subdivision of labor and the increasing use of machines, there is opportunity for mental development outside of working hours. The disadvantages of specialization and subdivision, so feared by economists and writers of a generation ago, have not proved so serious in their effects on the working classes as they appeared. On the contrary, never in any preceding period of the world's history did the working classes make greater progress, not only in their material welfare, but also in their intellectual development.

In biology, a conception borrowed from economics and introduced into biology by Milne-Edwards to describe the difference of function exhibited by the individual members of an animal colony, or by the different organs, tissues and cells of a single organism. The figure of a hydroid colony, *Hydractinia,* shows how members, primarily and fundamentally the same in structure, become set apart as nutritive, reproductive, sensitive and protective. The same division of labor on predominance of special functions in different individuals is beautifully illustrated in the *Siphonophora.*

DIVISION OF PUBLICATIONS, The. See AGRICULTURE, DEPARTMENT OF.

DIVITIACUS, chief of the Ædui, often mentioned in the 'Commentaries of Cæsar.' He was a constant adherent of the Romans, and on one occasion made a visit to Rome, where he became the guest of Cicero, who mentions him in his book, 'De Divinatione,' as belonging to the order of the Druids, and professing much knowledge of the mysteries of nature and the art of divination. In 58 B.C. when Cæsar refused permission to the Helvetii to migrate from Switzerland and settle in Gaul, he depended on the Ædui and Divitiacus furnished supplies for his army; but Dumnorix, the brother of Divitiacus, obtained the chief power among the Ædui and withheld the supplies. When this state of affairs became known to Cæsar he suppressed

Dumnorix and restored Divitiacus to power. Having thus assured the supplies for his army, Cæsar campaigned against the Helvetii, crushing them near the town of Bibracte.

DIVORCE, the disruption, by the act of law, of the conjugal tie made by a competent court on due cause shown. In the United States, jurisdiction in divorce cases is usually conferred on the law courts by the statutes in the different States. The causes of divorce enumerated in these various statutes are by no means uniform, and are more numerous in many of the western States than in the eastern. In all the States adultery is recognized as just ground for divorce. Conviction of felony is sufficient ground in all the States but Connecticut, Florida, Maine, Maryland, Mississippi, New Jersey, New York, North Carolina, Rhode Island, South Carolina and the District of Columbia. Cruelty is a sufficient ground in all States but Alabama, Arkansas, District of Columbia, Maryland, New York, North Carolina, Tennessee, Vermont, Virginia, Washington and West Virginia. Habitual drunkenness is accepted ground for divorce in all States but Alabama, District of Columbia, Georgia, Maryland, New Jersey, New York, North Carolina, Pennsylvania, South Carolina, Texas, Vermont, Virginia and West Virginia. Desertion for one year is sufficient ground in Arizona, Arkansas, California, Colorado, Florida, Hawaii, Kansas, Kentucky, Minnesota, Missouri, Montana, Nevada, North Dakota, Oklahoma, Oregon, Porto Rico, South Dakota, Utah, Washington, Wisconsin, Wyoming; desertion for two years in Alabama, Alaska, Delaware, Illinois, Indiana, Michigan, Mississippi, Nebraska, New Jersey, Pennsylvania and Tennessee; desertion for three years in Connecticut, Georgia, Maine, Maryland, Massachusetts, New Hampshire, Ohio, Texas, Vermont, Virginia and West Virginia; desertion for five years in Rhode Island. The drug habit is sufficient cause in Alabama, Colorado, Maine, Massachusetts, Mississippi and Rhode Island. Insanity is sufficient cause in the District of Columbia, Idaho, Iowa, Mississippi, New Jersey, North Dakota, Pennsylvania, Utah, Virginia, Washington, West Virginia and Wyoming. Neglect to provide is sufficient cause in California, Delaware, Idaho, Maine, Massachusetts, Michigan, Montana, New Mexico, North Dakota, Ohio, Rhode Island, South Dakota and Tennessee. In New York adultery is the only ground recognized by law for granting an absolute divorce. In South Carolina the courts have no power to grant divorce, strictly speaking, the legislature being the only authority for that purpose. In both of these States, as in others, the courts may declare an alleged marriage invalid on grounds which rendered the parties or either of them incapable of lawfully contracting it, such as idiocy, lunacy, former husband or wife living, etc. Separation from bed and board, commonly called limited divorce, is granted on the ground of cruel and inhuman treatment or incompatibility; and desertion and refusal to support by the husband may be a ground for a decree setting the wife free from the interference and control of her husband, though it may not sunder the marriage tie.

A person applying for a divorce will not be allowed to obtain judgment should it appear that he or she has also been guilty of the offense complained of, or that there is collusion between the persons concerned in order to procure a divorce. Moreover, the plaintiff is always required to prove the existence of the alleged grounds of divorce by satisfactory evidence, even though no contest is made on the other side. Parties also who have condoned the offense, that is, who, after it has been discovered, have consented again to live as husband and wife, are not allowed to obtain a divorce, but a second act of the same nature revives the right of action on the original offense.

The absence of harmony in the legislation of the different States on this subject has led to very great confusion and conflict in regard to the rights and liabilities growing out of divorce against non-residents of the State where granted, and some uniform system of laws on the subject is greatly needed. As the jurisdiction of Congress over the subject is doubtful, uniformity can apparently be secured only by an amendment to the Constitution of the United States or by the concurrent action of the various State legislatures.

The United States Bureau of the Census published in 1909 a special report upon marriage and divorce, covering the 40-year period, 1867 to 1906. The report shows that the total number of divorces granted in the United States in that period was 1,274,341, of which number 945,625 were granted in the latter 20 years — 1887 to 1906. Each 5-year period for the whole 40 years showed a marked increase over the 5 years immediately preceding, averaging about 30 per cent. During these periods the population was increasing only about 10 per cent.

Of the 945,625 divorces granted between 1887 and 1906, the causes for divorce arose after marriage in 922,152 cases. In 415,742 cases the cause was abandonment, or desertion; in 255,155 cases, cruel or inhuman treatment; in 174,558 cases, adultery; in 105,162 cases, neglect of duty, or to make proper provision; in 54,283 cases, habitual drunkenness; in 8,841 cases, conviction of felony; in 1,136 cases, violent temper; in 244 cases, insanity. Of divorces for causes existing at the time of marriage, there were 3,921. Of this total, bigamy accounted for 1,203; impotency for 1,092; and duress, force or fraud, for 465.

In the same 20-year period there were granted to husbands, 316,149 divorces, and to wives, 629,476. The causes on which the grants were made to husbands were: for desertion, 156,283; for adultery, 90,890; for cruelty, 33,178; for drunkenness, 3,436. The causes on which the grants were made to wives were: for desertion, 211,219; for cruelty, 173,047; for adultery, 62,869; for neglect, 34,664; for drunkenness, 33,080.

The largest proportion were granted the third, fourth or fifth year of marriage, being about 8 per cent of the whole for each of those years. About 5 per cent were granted in the first year, and 7 per cent in each of the second and sixth years. Half of the total number were granted before the close of the ninth year.

Geographically, the larger percentage of divorces granted obtains in the West, being about four times that of the Atlantic seaboard States. The Central section shows a rate about 2⅓

that of the East. Concretely, the figures show that since 1900 the annual dissolution of marriages in the United States has amounted to four out of each 1,000 marriages then existing.

The latest available figures for the several States are for 1900 and give the actual number of divorces granted in that year per each 100,000 married persons in the State, as follows: Washington, 513; Montana, 497; Colorado, 409; Arkansas, 399; Texas, 391; Oregon, 368; Wyoming, 361; Indiana, 355; Idaho, 347; Oklahoma, 346; Arizona, 344; Indian Territory, 326; Nevada, 315; California, 297; Kansas, 286; Maine, 282; Missouri, 281; Rhode Island, 281; Utah, 274; New Hampshire, 272; South Dakota, 270; North Dakota, 268; Illinois, 267; Tennessee, 261; Michigan, 257; Iowa, 246; Kentucky, 237; Ohio, 231; Florida, 226; Nebraska, 226; Mississippi, 225; Alabama, 208; New Mexico, 193; West Virginia, 183; Wisconsin, 180; Vermont, 177; District of Columbia, 162; Minnesota, 161; Connecticut, 130; Louisiana, 127; Massachusetts, 124; Virginia, 117; Maryland, 114; Pennsylvania, 94; Georgia, 78; North Carolina, 75; New Jersey, 60; New York, 60; Delaware, 43; South Carolina, 6.

Figures for the same year for foreign countries are based on the total population — not upon the married population. For each 100,000 population the number of divorces and separations were: Japan, 215; United States, 73; Switzerland, 38; Denmark, 29; Roumania, 28; France, 26; Germany, 23; Hungary, 18; Netherlands, 16; Belgium, 13; Bulgaria, 11; Australia, 9; Austria, 8; Norway, 8; Sweden, 8; Finland, 5; Scotland, 4; Italy, 3; Servia, 2; Great Britain and Ireland, 2. There are no statistics for Russia, and no parallel figures for Canada, Mexico, Central America and South America.

The differences in the divorce laws in the States account somewhat for the differences in the number of divorces granted in certain States. In some of the Western States, where high divorce rates prevail, divorces have frequently been obtained by residents of other States before the expiration of time necessary for a residence in a State before proceedings for divorce may be legally begun. There are more divorces, in proportion to the population, granted in the United States than in Europe. The number of divorce courts in the United States will account in a great measure for this difference; nearly every county court, except in New Mexico, New Jersey and South Carolina, or about 2,921 courts, having the power of granting divorces. There is but one divorce court in England, 28 in Germany and 79 in France. Canada has few applications for divorce. In the 21 years ending with 1888, 94 divorces had been granted in Nova Scotia and New Brunswick, together, and 41 in all the rest of the Dominion of Canada.

In England, the divorce court is composed of a judge ordinary, the three chiefs in the courts of common law, and three puisne judges. It is provided that either spouse may obtain a divorce on the ground of adultery, but in case the wife is petitioner the adultery must be accompanied by cruelty or desertion. By another act the power to pronounce a decree of divorce, which was at first reposed in the whole court, is given to the judge ordinary sitting alone; but in this case the decree so pronounced is a decree *nisi* and cannot become final for at least six months. After a decree of divorce the offending person is free to marry again, even with the paramour. But it is also enacted that no clergyman shall be compelled to solemnize the marriage of any person who has been divorced. He must, however, allow another clergyman, if willing to do so, to perform the marriage. The same general rules as to collusion, condonation, the conduct of the parties, etc., which obtain in the United States are law also in England. In order to guard against fraud by parties conniving to procure a divorce, power is given to the queen's proctor to interpose, in case he has reasonable grounds to suspect collusion or recrimination, in order to oppose a petition for divorce. By these acts parties are also entitled to obtain a judicial separation on the ground of adultery, cruelty or desertion. Judicial separation is declared to be in place of a separation "a mensa et thoro." A married woman, having obtained decree of judicial separation, is declared to be in all respects as a "femme sole" in regard to any property that she has or may acquire. Even before obtaining a separation a woman deserted by her husband may obtain from the court a protection for any property that she has or may acquire by her own industry.

In France there has been great opposition to any laxity in the divorce laws, but since the year 1884 French law has recognized three grounds of divorce: (1) Adultery; (2) outrage, cruelty or grievous injury; (3) conviction of an infamous crime. These causes of action are equally available to husband or wife; but it is provided that the wife shall not marry again till after the expiration of 10 months from the date of the dissolution of the previous marriage. It is further provided that, in cases where divorce is sought on the ground of outrage, cruelty or grievous injury, immediate divorce shall not be granted, but the parties may be granted separation for a year, with due provision for the wife's support during that time, at the end of which a final divorce may be granted if they have not been reunited in the meantime. Substantially the same rules as to condonation prevail as in the United States. All the proceedings necessary in such cases are carefully provided for by the code civil, as well as the consequences to the parties personal or proprietary.

In Germany, the question of divorce gave rise to a long contest. The General Prussian Code permitted divorce on the ground of mutual consent and deep-seated aversion, but on account of the newly-awakened religious life in the 19th century there was strong opposition; this under Friedrich Wilhelm IV arose to an overwhelming power. Many attempts were made to establish the laws of divorce on other bases, but on account of the personal antagonism of Friedrich Wilhelm IV they remained without result. The demand for the biblical ground of divorce was fulfilled by the state, because the Bible does not offer a precise and comprehensive ground of separation. It was claimed that the Prussian law of divorce was lax and capricious and there was a unanimous demand for a more strenuous law in the interest of morals. This demand found recognition even in circles which were most opposed to ecclesiastical influence in politics. The opposing elements were reconciled by the personal influence of Friederich Wilhelm IV; but the

attempts of the legislature to make a new regulation of divorce remained without results. At the present time attempts are being made for bringing about a common divorce law for all of Germany. This proposed law rests theoretically on very strict principles which find justification in the motives. The Austrian code of common law allows to non-Catholic Christians separation from the bonds of matrimony on account of adultery, malicious desertion, five years' imprisonment, or on account of dangerous diseases and repeated cruelty of treatment and invincible aversion.

Among the Jews: The enactment of the Mosaic law was the following: "When a man hath taken a wife, . . . and it come to pass that she find no favor in his eyes because he hath found some uncleanness in her, then let him write her a bill of divorcement, and give it in her hand and send her out of his house" (Deut. xxiv, 1). Here, it will be perceived, impurity is the only assigned cause for such divorce. The woman sent away might marry another man, but if he, too, divorced her, it was not permitted her first husband to take her again. The word "uncleanness" in the passage now quoted is a free translation: the Hebrew words mean literally "the nakedness of a thing." The exact import of this expression was sharply contested in the immediately pre-Christian times, the school of Hillel giving it a general meaning, and holding that a man might divorce his wife for the most trivial cause; while that of Shammai considered that the doubtful phrase signified adultery, for which therefore alone a man could put away his wife.

The Mohammedan law of divorce, founded on some passages in the Koran, allows of a separation by mutual consent, giving the wife the right of retaining her marriage portion, unless she agrees to relinquish a part of it as the price of the separation. The parties are permitted to separate and reunite twice, if they can so agree without any particular conditions; but after the third divorce the husband is not permitted to receive his wife again until she shall have previously married another husband. The act of divorce is a judicial proceeding before the cadi, who does not decree it until three months after the application.

The Hindu and Chinese laws of divorce show little regard for women, and not only the causes recognized in European and American countries, but others, are deemed sufficient for a husband to discard his wife.

The different Grecian states had each their respective laws of divorce. At Sparta they do not seem to have greatly regarded the delicacy of the marriage bed when the interest of the republic was in question; but divorces appear to have been rare, since the *ephori* fined Lysander for repudiating his wife. At Athens either the husband or wife might procure a divorce by exhibiting a bill for this purpose to the archon, and obtaining the verdict or consent of a jury to whom the question was referred. But the party applying must, it seems, have made application personally; and Alcibiades, according to Plutarch, took advantage of his authority as a husband to prevent his wife from making the application personally; for when she was going from her brother's house, where she had taken refuge, to the archon's, to sue for a divorce, he forcibly seized upon her and confined her to his own house.

The early laws of Rome permitted the husband to divorce his wife for poisoning his children, counterfeiting his keys or adultery. But other causes were afterward added; for the first divorce recorded was for the sterility of the wife. This was by Sp. Carrilius Ruga, about 230 B.C. Divorces afterward became very frequent and a law was, on this account, made by Augustus, requiring additional ceremonies in a divorce; among other things, the presence of seven witnesses to the act of dissolution of the marriage. By the Theodosian code the husband could divorce the wife for adultery; or if she was a witch or a murderess; had sold a free-born person into slavery; violated a sepulchre; committed sacrilege; been accessory to theft or robbery; was given to feasting with strangers without the knowledge or against the wishes of the husband; lodged abroad without good reason; or frequented theatres and shows, her husband forbidding; or was aiding and abetting in plots against the state; or dealt falsely; or offered blows. The wife had equivalent rights in this respect, for she could procure a divorce on similar offenses against her husband. He could be remarried immediately; she, not within a year.

The facility of divorce continued, without restriction, under the Roman emperors, but as the modern nations of Europe emerged from the ruins of the Roman empire, they adopted the usual interpretation of the doctrine of the New Testament (Matt. xix, 6), "What God hath joined together, let no man put asunder."

Divorce under the laws of the Roman Catholic Church is never allowed where the marriage has been duly contracted, ratified and consummated. But a perfectly valid marriage contracted between baptized persons can be annulled by the Pope, before its consummation, never after consummation. It is held by canonists that a marriage lawfully and validly contracted but not consummated is annulled by either of the parties taking solemn lifetime vows of continence and entering a religious order. If of two unbaptized persons, married, one is converted to the faith and receives baptism, he or she may be released from the marriage bond if either party refuse to live peaceably and without insult to the Christian religion in the marriage state; and then the released party can marry again. Outside of such conditions as have been stated Christians united in marriage cannot in the Roman Catholic Church be freed from the marriage bond, *vinculum matrimonii*, save by the death of one or other of them. See FAMILY, LAW OF; HUSBAND AND WIFE, LAW OF; MARRIAGE, LAW OF.

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RICHARD FERRIS,
Editorial Staff of The Americana.

DIVORCE, Court of. See COURT.

DIX, Beulah Marie, (Mrs. George H. Flebbe), American novelist and playwright: b.

Kingston, Mass., 25 Dec. 1876. She has published 'Hugh Gwyeth' (1899); 'Soldier Rigdale' (1899); 'The Making of Christopher Ferringham' (1901); 'The Beau's Comedy' (with C. A. Harper, 1902); 'A Little Captive Lad' (1902); 'Blount of Breckenhow' (1903); 'The Fair Maid of Graystons' (1905); 'Merrylips' (1906); 'Allison's Land' (1910); 'Betty-Bide-at-Home' (1912); 'Mother's Son' (1913); 'Little God Ebisu'; 'Maud Melicent' (1914); 'Battle Months of George Daurella'; 'Blithe McBride' (1916); and is author of two plays, 'Across the Border' (1914); 'Moloch' (1915).

DIX, Dorothea Lynde, American philanthropist: b. Hampton, Me., 4 April 1802; d. Trenton, N. J., 17 July 1887. In her youth she supported herself by teaching in Worcester, Mass., but in 1830 fell heir to some property, after which she devoted her life to the relief and betterment of lunatics, paupers and criminals. She visited the prisons, asylums and almshouses of nearly every State in the Union, and by her efforts contributed largely to the establishment of lunatic asylums in those States which had none. She also traveled extensively in Europe in the same service, and her efforts materially improved the condition of the insane there likewise. She published several children's books and in 1845 'Prisons and Prison Discipline.' In 1903 a bill was favorably received in Congress appropriating $10,000 for a monument to her at her birthplace. The report of the House committee declares: "Miss Dix occupies a conspicuous place in history as a philanthropist. Certainly no other woman in modern times has done more to earn the gratitude of the people of this country than this self-sacrificing and devoted woman. Her services durthe Civil War as chief of the hospital nurses of the United States and her wonderful success in establishing institutions for the insane — over 30 in number — in the South and West and elsewhere in the country, place her among the noblest examples of humanity in all history." Consult Tiffany, 'Life of Dorothea Lynde Dix' (Boston 1890).

DIX, John Adams, American statesman and soldier: b. Boscawen, N. H., 24 July 1798; d. New York, 21 April 1879. In 1812 he was appointed a cadet in the United States army and in 1813 ensign. He took part in the operations on the Canadian frontier during the War of 1812, afterward studied law and was admitted to the bar in Washington. In 1826 he was sent as a special messenger to the court of Denmark. He resigned from the army in 1828 and began practising law in Cooperstown, N. Y. Later he was secretary of State and adjutant-general of New York and was prominently associated with the "Albany Regency," the controlling power of the Democratic party. In 1841 he was elected to the State assembly and in 1845–49 was a United States senator. In 1861 he was appointed Secretary of the Treasury by President Buchanan. At this time there were two revenue cutters at New Orleans and he ordered them to New York. The captain of one refused to obey his order and Dix telegraphed to put him under arrest, adding the statement which has made him famous, "If any one attempts to haul down the American flag, shoot him on the spot." At the outbreak of the Civil War he was elected president of the Union Defense Committee and organized 17 regiments. He was commissioned a major-general of volunteers and through his active measures saved Maryland to the Union cause. In May 1862 he was sent to Fortress Monroe and after the New York Draft Riots in July 1863 he was appointed commander of the Department of the East at New York and remained in this relation until July 1865, when he returned to civil life. He was United States Minister to France from 1866 to 1869. He was elected governor of New York in 1872, but was defeated on a renomination in 1874. His publications include 'Resources of the City of New York' (1827); 'Decisions of the Superintendents of Common Schools of New York, and Laws Relating to Common Schools' (1837); 'A Winter in Madeira and a Summer in Spain and Florence' (1850); 'Speeches and Occasional Addresses' (2 vols., 1864). Consult Dix, Morgan, 'Memoirs of John A. Dix' (New York 1883).

DIX, John Alden, American statesman: b. Glens Falls, N. Y., 25 Dec. 1860. He was graduated at the Glens Falls Academy in 1879 and at Cornell University in 1883. Entering the lumber and paper-making business he became president of the Iroquois Paper Company, treasurer of the American Wood Board Company, vice-president of the Blandy Paper Company and of the First National Bank of Albany. He was also manager of the Moose River Lumber Company and director of the Albany Trust Company, the Glens Falls Trust Company and other corporations. He was delegate to the Democratic National Convention at Saint Louis in 1904, received 17 votes for the gubernatorial nomination in 1906 and was Democratic nominee for lieutenant-governor in 1908. He was chairman of the Democratic State committee in 1910 and was governor of New York for the term 1911–12.

DIX, Morgan, American Episcopal clergyman: b. New York, 1 Nov. 1827; d. there, 29 April 1908. He was a son of J. A. Dix (q.v.). He was graduated from Columbia College in 1848 and from the General Theological Seminary in 1852. He then took orders in the Episcopal Church and after serving for a few years as assistant in Trinity Church, New York, became in 1862 the rector of Trinity parish. In November 1902 the 40th anniversary of his rectorship was celebrated. Prior to 1901 he was president of the House of Clerical and Lay Deputies in many successive general conventions of the Episcopal Church. He published 'Commentary on the Epistle to the Romans' (1864); 'Exposition of the Epistles to the Galatians and Colossians' (1865); 'Lectures on the Pantheistic Idea of an Impersonal Substance Deity' (1865); 'Lectures on the Two Estates' (1872); 'Memoirs of John A. Dix' (1883); 'History of the Parish of Trinity Church' (4 vols., 1898–1906).

DIXIE, Lady Florence Caroline Douglas, English explorer, poet and novelist: b. London, 24 May 1857; d. 7 Nov. 1905. She was the youngest daughter of the seventh Marquis of Queensberry and was married to Sir Alexander Beaumont Churchill Dixie. She explored Patagonia 1878–79, was war correspondent for the London *Morning Post* in the Boer War 1880–81 and was instrumental in securing the liberty of Cetewayo, king of Zululand. In her later years

she became a zealous advocate of sex equality; her last works reveal the extent to which this subject had taken possession of her mind. She published 'The Songs of a Child and Other Poems'; 'Across Patagonia'; 'In the Land of Misfortune'; 'A Defense of Zululand and Its King'; 'The Child Hunters of Patagonia'; 'Aniwee or the Warrior Queen'; 'Gloriana'; 'Redeemed in Blood'; 'Little Cherie'; 'Ijain, or the Evolution of a Mind'; 'Isola,' a drama; 'Two Castaways,' etc.

DIXIE, a name associated in negro minstrelsy with the Southern States. It is supposed to be derived from the name of one Dixie, a large-holding and kind-hearted slave owner on Manhattan Island in the latter part of the 18th century. His treatment of his negroes caused them to regard his plantation (or "Dixie's") as little short of an earthly paradise, and when any of the slaves were taken away from home they always pined for "Dixie's" while singing and talking of its joys. When slavery moved southward in search of a more secure and congenial habitat the same ideal of "Dixie's" was taken along, and the chant which the former slaves of Dixie sang of their old home became so widespread that its origin was lost sight of and it came to be applied to the Southern homes of the negroes.

In fact in the South "Dixie" is held to mean the Southern States, the word being regarded as a derivation and corruption of "Mason and Dixon's line" (q.v.) which originally divided the free and slave States and was supposed by the Southerners to have first come into use when Texas joined the Union and the negroes frequently sang of it as "Dixie."

Daniel Decatur Emmett (1815–1904) composed a song known by this name as a "walk-around" for Bryant's Minstrels in 1859, and it was first performed at the Mechanics' Hall in New York. It was first used as a song by the Confederates at the inauguration of Jefferson Davis as President at Montgomery (18 Feb. 1861) and was afterward distinctively the Confederate song of the War of Secession. On 30 May of the same year a version of the same song appeared in the *Natchez Courier* from the pen of Gen. Albert Pike and also written in the Confederate interest. A third version, but associated with the cause of the North, was written by T. M. Cooley.

DIXMUDE, dĭks'mood-ę, (Flemish Diksmuiden), a town of Belgium on the Yser Canal, about 15 miles southwest of Ostend and 10 miles from the coast, with a population in 1914 of 4,000. A quaint, old-fashioned place, all bricks and tiles, dotted with cafés and nunneries, Dixmude is the centre of an essentially agricultural district. Surrounded by flat meadows and beet-root fields, intersected by canals and marshes, the district has been reconquered from the sea by centuries of effort. The sea is kept under control by a formidable array of sluices, locks, chambers, water-gates and cranks at Nieuport, eight miles away. In the European War Dixmude witnessed stirring scenes during October 1914. After the fall of Antwerp on the 9th a brigade of French marines, numbering 6,000 and commanded by Rear-Admiral Ronarc'h, was thrown into the town to assist the retreating Belgians in holding the Yser line against the German rush to the sea. Outnumbered by six to one the marines held Dixmude for nearly four weeks, fighting desperately in rags under incessant rain, barring the road to Dunkirk, ensuring the safety of the Belgian army and enabling the French armies of the North to concentrate behind the Yser. All the civil population had left the town. On 25 October the Belgian General Headquarters Staff at the suggestion, it is said, of M. Charles Kogge, *garde wateringue* of the north of Furnes, decided to call the waters to their aid. The sluices and water-gates at Nieuport were opened, the sea entered and forced back the fresh waters of the canal and its tributaries. By slow degrees the water rose in a few days and converted a zone of about 25 square miles into one vast lagoon. Flat-bottomed British monitors, assisted by French and British warships off the coast, fought off the German attempt on Nieuport for 10 days and saved it. The German forces and guns floundered in water and mud, hundreds were drowned and the main struggle for the shortest route to Calais came to an end. The French marines held their position. The loss of Dixmude before 1 November would have been disastrous to the Belgian right. As many as 15 attacks were repelled in one night. On 10 Nov. 1914 Dixmude fell after a heavy bombardment. Consult Le Goffic, C., 'Dixmude' (London 1916). See WAR, EUROPEAN — INVASION OF BELGIUM.

DIXON, Amzi Clarence, American clergyman: b. Shelby, N. C., 6 July 1854. He was graduated at Wake Forest College in 1875 and took his theological course at the Southern Baptist Theological Seminary. He was ordained to the Baptist ministry in 1876 and subsequently until 1883 held pastorates at Chapel Hill and Asheville, N. C. After 1883 he successively held pastorates in Baltimore 1883–90, Brooklyn 1890–96, Boston 1896–1901, Chicago 1906–11, and since 1911 at the Metropolitan Tabernacle, London. He has published 'Milk and Meat' (1893; new ed., 1913); 'Heaven on Earth' (1896); 'The Lights and Shadows of American Life' (1903); 'The Christian Science Delusion' (1903); 'Present-Day Life and Religion' (1905); 'Evangelism, Old and New' (1905); 'The Young Convert's Problems' (1906); 'The Bright Side of Life and Other Sermons' (1914); 'The Glories of the Cross and Other Addresses' (1914); 'Through Night to Morning' (1913).

DIXON, Archibald, American statesman: b. Caswell County, N. C., 2 April 1802; d. Henderson, Ky., 23 April 1876. In 1805 he removed with his father to Henderson County, Ky., where he received a common-school education, studied law and was admitted to the bar in 1824, and attained high rank as a criminal lawyer. He was a member of the legislature in 1830 and 1841, of the State senate in 1836 and lieutenant-governor in 1843–47. In 1849, when the proposition for gradual emancipation of the slaves was before the people, he vehemently opposed the scheme, and, being chosen a member of the Constitutional Convention, proposed a resolution which was substantially incorporated in the new constitution, declaring that whereas the right of the citizen to be secure in his person and property lies at the bottom of all governments, and slaves and children hereafter born of slave mothers are property, therefore

the convention has not the power nor the right to deprive the citizen of his property except for the public good, and only then by making to him a just compensation. Dixon was the Whig candidate for governor in 1851, but he was not supported by the emancipationists in that body and a Democrat was elected. During the agitation for the dissolution of the Union, Dixon eloquently seconded before the people the appeals for its preservation uttered in Washington by Clay and Webster. He and Crittenden were rival candidates before the legislature for the next seat that fell vacant in the United States Senate, but for the sake of party harmony both withdrew. When Henry Clay died, shortly afterward, Mr. Dixon was elected for the unexpired term. He took his seat on 20 Dec. 1852, and served to 3 March 1855. During the Civil War he was an advocate of peace, and in 1863 was a delegate to the peace convention at Frankfort, Ky.

DIXON, Charles, English naturalist: b. London, England, 20 July 1858. His entire life has been devoted to natural history study, bird migration and the geographical distribution of species having been his especial field. His published books include 'Rural Bird Life' (1880); 'Evolution without Natural Selection' (1885); 'Our Rarer Birds' (1888); Stray Feathers from Many Birds' (1890); 'Annals of Bird Life' (1890); 'Idle Hours with Nature' (1891); 'The Birds of Our Rambles' (1891); 'The Migration of Birds' (1892); 'Jottings About Birds' (1893); 'Game Birds and Wild Fowl of the British Islands' (1893); 'Nests and Eggs of British Birds' (1893); 'Nests and Eggs of Non-indigenous British Birds' (1894); 'The Migration of British Birds' (1895); 'British Sea Birds' (1896); 'Curiosities of Bird Life' (1897); 'Our Favorite Song Birds' (1897); 'Lost and Vanishing Birds' (1898); 'Bird Life in a Southern Country' (1899); 'Among the Birds in Northern Shires' (1900); 'The Story of the Birds' (1900); 'Birds' Nests' (1902); 'Open Air Studies in Bird Life' (1903); 'The Bird Life of London' (1909).

DIXON, Frank Haigh, American educator: b. Winona, Minn., 8 Oct. 1869. He was graduated at the University of Michigan 1892, and has been assistant professor of economics in Dartmouth College since 1898, and secretary of the Amos Tuck School of Administration and Finance since 1900. He was expert adviser to the Interstate Commerce Commission (1907–08) and to the National Waterways Commission (1909), and in 1910 became chief statistician to the Bureau of American Railway Economics. Besides contributing to magazines, he published 'State Railroad Control' (1896); 'Recent Railroad Commission Legislation' (1905); 'A Traffic History of the Mississippi River System' (1909).

DIXON, James, American lawyer and statesman: b. Enfield, Conn., 5 Aug. 1814; d. Hartford, Conn., 27 March 1873. He was graduated at Williams College, and achieved distinction in the practice of law, but turning his attention to public affairs was repeatedly elected to the Connecticut legislature as a Whig, served two terms in the United States House of Representatives and was a member of the United States Senate from 1857 to 1869.

DIXON, James Main, American educator: b. Paisley, Scotland, 20 April 1856. He was educated at the University of Saint Andrews, was professor of English in the Imperial College of Engineering, Japan, 1879–86; professor of English in the Imperial University of Japan 1886–92, and professor of English literature in Washington University 1892–1901. In 1903–04 he was president of Columbia College, Milton, Ore. He was professor of English literature at the University of Southern California from 1905 to 1911, when he was transferred to the chair of Oriental studies and comparative literature. In 1906 he became literary editor of the *West Coast Magazine*. He compiled a 'Dictionary of Idiomatic English Phrases' (1891) and wrote 'Illustrated History of Methodism' (1900); 'Twentieth Century Life of John Wesley' (1902); "Matthew Arnold," in 'Modern Poets and Christian Teaching' (1906); 'A Survey of Scottish Literature in the Nineteenth Century' (1907).

DIXON, Joseph, American inventor: b. 1799; d. 1869. He was at various times shoemaker, printer, wood engraver and physician, and establishing crucible works in 1827 at Salem, Mass., became very wealthy. In the course of his experiments he devised important improvements in photography, lithography, lens grinding, smelting, bank-note printing, etc.

DIXON, Joseph Moore, American lawyer and public official: b. Snow Camp, N. C., 31 July 1867. He received his education at Earlham College (Indiana) and at Guilford College (North Carolina). He was admitted to the bar in 1892 and has since practised at Missoula, Mont. He was assistant prosecuting attorney 1893–95, prosecuting attorney 1895–97 of Missoula County and member of the Montana house of representatives in 1900. In 1903–07 he was member of the United States House of Representatives, being elected from Montana at large. He was also delegate-at-large to the Republican National Convention of 1904. In 1907–13 he was United States Senator from Montana. He is publisher of the *Daily Missoulian* and the *Evening Sentinel* of Missoula, Mont.

DIXON, Richard Watson, English clergyman and author: b. London 1833; d. 2 Jan. 1900. He was educated at Oxford; was master in the high school at Carlisle in 1863 and canon of Carlisle in 1874. He became vicar of Hayton in 1873 and of Warkworth in 1883. He published 'Christ's Company and other Poems' (1861); 'Historical Odes and other Poems' (1864); 'Mano, a Poetical History' (1883); 'Odes and Eclogues' (1884); 'Lyrical Poems' (1885); 'The Story of Eudocia and Her Brothers, a Narrative Poem' (1887); 'Songs and Odes' (1896); 'Essay on the Maintenance of the Church of England' (1875); 'Life of James Dixon' (1874); and 'History of the Church of England from the Abolition of the Roman Jurisdiction' (1880–1900). He was associated with Burne-Jones, Rossetti and Morris in founding the *Oxford and Cambridge Magazine*, the chief organ of the pre-Raphaelite school.

DIXON, Roland Burrage, American anthropologist: b. Worcester, Mass., 6 Nov. 1875. He was graduated in 1897 from Harvard University and immediately became an assistant in anthropology there, becoming instructor in 1900

and assistant professor in 1906. He is a Fellow of the American Academy of Arts and Sciences and is author of various papers and monographs on the Indians of California and the Indians of North America in general, including 'Maidu Myths' (1902); 'The Chimariko Indians and Language' (1910); 'Maidu Texts' (1912).

DIXON, Thomas, American novelist and playwright: b. Shelby, N. C., 11 Jan. 1864. He was graduated at Wake Forest College, N. C., 1883, and Greensboro, N. C., Law School 1886, and admitted to the bar in the last-named year. After serving from 1884–86 as member of the legislature in North Carolina he resigned to enter the Baptist ministry. He was pastor in Raleigh, N. C., 1887; Boston, Mass., 1888–89, and New York 1889–99. Among his works are 'Living Problems in Religion and Social Science' (1891); 'What is Religion?' (1892); 'The Failure of Protestantism' (1896); 'Sermons on Ingersoll' (1894); 'The Leopard's Spots' (1902); 'The One Woman' (1903); 'The Clansman' (1904); 'The Life Worth Living' (1905); 'The Traitor' (1907); 'Comrades' (1909); 'The Root of Evil' (1911); 'The Sins of the Father' (1912); 'The Southerner' (1913); 'The Victim' (1914); 'The Foolish Virgin' (1915); 'The Fall of a Nation' (1916). He was made director-general of the National Drama Corporation (1915).

DIXON, William Hepworth, English author: b. Manchester, 30 June 1821; d. London, 27 Dec. 1879. In 1849 he published a memoir of Howard, the philanthropist, followed by the 'Life of William Penn' (1851), and by a work on Admiral Blake (1852). In 1853 he became editor of the *Athenæum,* a post which he retained till 1869. During this period he published several very popular works, including the 'Personal History of Lord Bacon.' After his retirement from the *Athenæum* he wrote some 25 volumes of history, travel and fiction.

DIXON, William Macneile, English scholar: b. India 1866. He was educated at Trinity College, Dublin, and has been professor of English literature in the University of Glasgow from 1904. He has published 'English Poetry from Blake to Browning'; 'A Tennyson Primer'; 'In the Republic of Letters'; 'History of Trinity College, Dublin'; 'English Epic and Heroic Poetry.'

DIXON, Ill., county-seat of Lee County, situated on the Rock River, about 65 miles above its junction with the Mississippi River and on the Illinois Central and the Chicago and Northwestern railroads. The city contains a courthouse, public library, the Rock River Military Institute, the Northern Illinois Normal School and the Rock River Chautauqua. The industrial establishments of the city comprise shoe factories, wagon works, condensed milk factories, farm implement works, furniture and wire cloth works and a Portland cement factory. The city was first settled in 1836; in 1911 the commission plan of government was put in operation. Pop. 8,000.

DIXON ENTRANCE, a strait on the west coast of North America, separating Queen Charlotte Islands from the Prince of Wales Archipelago, and so dividing British territory from a part of Alaska. It is about 100 miles long from east to west and 70 miles wide.

DIXWELL, John, English regicide: b. 1608; d. 18 March 1689. in 1646 he was elected member for Dover in the House of Commons, was one of the judges who condemned Charles I to death and signed the warrant. After the reaction in England which placed Charles II upon the throne, and caused himself and his associates in the trial to be excepted from the general pardon, he escaped to America, changed his name, taking that of John Davids, and lived undiscovered among the inhabitants of New Haven, where he was married and left children. In 1664 he visited two of his fellow regicides, Whalley and Goffe, who had found a refuge amid the solitudes of Hadley, Mass. His favorite study in exile was Raleigh's 'History of the World,' and he cherished a constant faith that the spirit of liberty in England would produce a new revolution. Consult Stiles, 'History of Three of the Judges of Charles I: Whalley, Goffe and Dixwell' (Hartford 1794).

DIZFUL, dēz-fool', Persia, capital of the province of Arabistan, about 190 miles west of Ispahan, on the river Diz. It has over 35 sacred tombs, and nearly as many mosques, a number of schools and baths; but on account of the heat half of the town consists of subterranean excavations in the rock. The river is crossed by a handsome bridge of 22 arches. The chief article of commerce is indigo. Its pens, made of oak, are famous throughout the Orient. Pop. about 25,000.

DJEZZAR, jĕz'zär ("butcher"), the name given to Achmed Pasha: b. Bosnia about 1735; d. Acre 1804. He was born in Bosnia of Christian parents, but embraced Mohammedanism. He was famous for his obstinate defense of Acre against Napoleon I. He rose, through murder and treason, from the condition of a slave to be pasha of Acre. In the beginning of 1799 the French entered Syria from Egypt, and advanced from victory to victory till they reached Acre, which was laid siege to on 20 March. By advice of Sir Sidney Smith, Djezzar was induced to hold out; and such was the savage doggedness of his defense that Bonaparte was obliged to retire on 21 May.

DMITRIEFF, mĭt'ryĕf, **Radko,** Bulgarian general: b. Grodez, Bulgaria, then a Turkish province. When his country obtained her independence (1878) he was one of the first pupils to pass through the new military academy at Sofia. The Bulgarian army being then entirely under Russian control, he completed his studies in Saint Petersburg (Petrograd), and returned home with the rank of captain on the eve of the Serbo-Bulgarian War of 1885. Immediately promoted to colonel, Dmitrieff commanded a regiment in the Slivnitza campaign. He became implicated in the conspiracy which led to the abdication of Prince Alexander. Driven out of the country by Stambulov, Dmitrieff served over 10 years in the Russian army, but returned after the accession of Prince — now King — Ferdinand. In 1902 he was made chief of the general staff and placed in command of the military district on the Turkish frontier. In the first Balkan War (q. v.) he commanded one of the Bulgarian armies and won the first victory of Kirk Kilisseh. He was regarded as a popular hero, but weary of the quarrels among the Balkan Allies, he re-entered the

Russian service as a general. In the European War he was one of the youngest of the great army leaders. When Bulgaria refused to aid Serbia against Austria, Dmitrieff returned all his decorations to King Ferdinand and definitely cast in his lot with the Russians. He performed marvels of fighting in the Galician and Carpathian campaigns. When von Mackensen began his great Galician drive in the spring of 1915, he opened his attack against the Dunajec-Biala line held by Dmitrieff, broke through at Gorlice, and inflicted a severe defeat upon the Russians, which resulted in the reconquest of the whole province for Austria. Dmitrieff was relieved of his command and brought before a military tribunal. As his failure was due to lack of artillery he was honorably acquitted and reinstated. He served with distinction two years longer and resigned in July 1917. See WAR, EUROPEAN — GALICIAN and CARPATHIAN CAMPAIGNS.

DNIEPER, nē'pĕr (Russian, DNJEPR, dnyĕp'ĕr; ancient BORYSTHENES), a river of Russia which rises in the government of Smolensk, flows south to Kiev, then southeast to Ekaterinoslaff. Here it takes a southerly direction, flowing between steep, rocky banks and at a very swift rate through rapids which require the most expert pilots to bring a vessel over them in safety and then only at high water. From Alexandrovsk the direction is toward the southwest. It gradually forms the estuary called the Dnieper Liman and flows into the Black Sea near Kherson. The river begins to be navigable above Smolensk. It has a total length of over 1,400 miles. The watershed or basin of the Dniper is about 202,000 square miles in extent and is inhabited by a population estimated at 14,000,000, who cultivate this fertile region famous for its black soil. The fishing industry of the river is also important and lucrative. The annual commerce on the river in normal times is about $60,000,000, and consists chiefly of lumber and grain. The Beresina Canal connects the river with the Baltic, via the Beresina, Dwina, the Pripet and the Dnieper-Bug and Niemen canals. It is closed to navigation in its upper course during the winter months, but its lower course is closed only for about two months in midwinter.

DNIESTER, nēs'tĕr (Russian, DNJESTR, dnyĕs'tĕr; the ancient TYRAS; later DANASTRIS or DANASTUS), a large river of Europe, which has its source in a lake in the Carpathian Mountains, in Austrian Galicia. Near Khotin it crosses the Russian frontier and flows in a southeastern direction generally with many windings. It forms the boundaries between Bessarabia and Podolia and Kherson. It flows into the Black Sea between Ovidiopol and Ackerman. Its length is over 850 miles, 360 of which are in Austria. Its basin is about 30,000 square miles in extent; is mostly high land. There are rapids at Yampol. The chief affluents of the Dniester are the Sereth and the Stry. Modern improvements have made the river navigable from Khotin to the sea and its annual volume of commerce is very great, consisting for the most part of grain and lumber. It abounds in fish which are also a source of wealth and the catching of which gives a means of livelihood to thousands.

DOAB, doo'ăb (Sanskrit, "Two Waters"), a name in Hindu applied indiscriminately to any tract of country between two rivers, but especially to the tract between the Ganges and the Jumna in the United Provinces. It is 500 miles long and 55 broad. It is the greatest wheat-producing area in the United Provinces. Its rich alluvial soil is irrigated by three canals. Other similar tracts have their distinctive name, as the Bari Doab, between the Bias and Ghara and the Ravi; the Rechna Doab, between the Ravi and the Chenab; the Jech Doab, between the Jhelum and the Chenab, the Sind Sagar Doab, between the Indus and the Jhelum. The canal parallel to the Jumna from Delhi to Fyzabad is called the Doab Canal.

DOAK, dōk, **Samuel,** American Presbyterian clergyman: b. Augusta County, Va., 1 Aug. 1749; d. Bethel, N. C., 12 Dec. 1830. He was graduated from Princeton; was for a time tutor in Hampton Sidney College; and was licensed to preach in 1777. He first settled at Holston, and later at Salem, Tenn., where he built a small church, formed the Salem congregation, and established a school, the first organized in the Mississippi Valley west of the Alleghanies. It was incorporated in 1785 as Martin Academy, and in 1795 became Washington College; Doak was its president from 1795 to 1818. He then removed to Bethel, where he founded Tusculum Academy. He was known as "the apostle of learning and religion in the West."

DOANE, dōn, **George Hobart,** American Roman Catholic clergyman: b. Boston, Mass., 5 Sept. 1830; d. Newark, N. J., 20 Jan. 1905. He was graduated at Jefferson Medical College in 1850, became a deacon in the Protestant Episcopal Church, but later entered the Roman Catholic Church and was ordained priest in 1857. In 1873 he was made vicar-general of Newark, N. J., and in 1886 the Pope made him a domestic prelate with the title of monsignore. He wrote: 'First Principles'; 'Exclusion of Protestant Worship from Rome,' etc.

DOANE, George Washington, American Episcopal bishop: b. Trenton, N. J., 27 May 1799; d. Burlington, N. J., 27 April 1859. He was educated at Union College and the General Theological Seminary in New York. He was ordained deacon in 1821 and priest two years later, having become in the meantime an assistant in Trinity Parish, New York. Here he remained until 1824, when he was appointed professor of rhetoric and *belles-lettres* in Washington (now Trinity) College, Hartford. This position he held for four years, going then to Boston as assistant and afterward rector of Trinity Church. In 1832 he was consecrated bishop of New Jersey, and took up his residence in Burlington, N. J., combining the rectorship of Saint Mary's Church with the episcopate until his death. Besides a vigorous prosecution of general religious work in his diocese, he devoted himself especially to the promotion of Christian education. In 1837 he founded Saint Mary's Hall, a boarding and day school for girls, at Burlington, and in 1846 organized Burlington College in the same town. His zeal in this direction, combined with incomplete knowledge of business principles, led to

financial embarrassment and ultimately to presentment for trial before his brother bishops; but though twice brought up, the charge was unanimously dismissed. In many ways Bishop Doane was far in advance of his time, advocating daily services and the free church system when they were practically unknown in America. He left a large number of published sermons, lectures and essays, and was also a poet of no mean ability, his best-known poems being that beginning 'What is That, Mother?' and the well-known hymn 'Softly Now the Light of Day.'

DOANE, William Croswell, American Protestant Episcopal bishop, b. Boston, 2 March 1832; d. Albany, N. Y., 17 May 1913. He was a son of G. W. Doane (q.v.). He was ordained deacon (1853) and priest (1856) in Saint Mary's Church, Burlington, N. J., serving as assistant there until the latter date, when he took charge of Saint Barnabas' Church, Burlington. He succeeded his father in the rectorship of Saint Mary's (1859–61), and after holding rectorships at Hartford, Conn. (1861–67), and Albany (1867–69), became in the year last named the first bishop of Albany, on the division of the large diocese of New York. In this position he acquired a reputation as a wise and statesmanlike administrator, and a diligent promoter of religious education. Saint Agnes' School at Albany was founded by him. He took a prominent part in the second, third and fourth Lambeth Conferences, and in the discussions on the revision of the American prayer-book, to which his liturgical knowledge made valuable contributions. He was a firm believer in the cathedral system, and spent much labor on its organization at Albany, including the erection of a magnificent cathedral. In 1902 he was chosen chancellor of the regents of the University of the State of New York. His most important literary work is his 'Life of Bishop George Washington Doane' (1860). He has published also 'Mosaics, or the Harmony of the Collects, Epistles, and Gospels' (1881); 'A Catechism of the Christian Year'; 'The Manifestations of the Risen Lord'; 'Rhymes from Time to Time' (1901).

DOANE, William Howard, American composer: b. Preston, Conn., 3 Feb. 1831; d. Cincinnati, Ohio, 24 Dec. 1915. He was chief editor of the Baptist 'Hymnal' and composed numerous popular evangelistic hymns and songs. He also published more than 20 collections of hymns and several cantatas. He early removed to Cincinnati where he was president and general manager of a firm of manufacturers of wood-working machinery from 1861 till his death.

DOBBIN, James Cochrane, American statesman: b. Fayetteville, N. C., 1814; d. there, 4 Aug. 1857. He was graduated at the University of North Carolina in 1832, studied law, was admitted to the bar in 1835 and practised in Fayetteville. He was elected to Congress from North Carolina as a Democrat, and served from 1 Dec. 1845 to 3 March 1847. He was a member of the State legislature in 1848–52 and was chosen speaker in 1850. He was a member of the Democratic National Convention at Baltimore in 1852, and appointed Secretary of the Navy by President Pierce, serving from 7 March 1853 to 6 March 1857.

DOBBS FERRY, N. Y., residential village in Westchester County, on the Hudson River, and on the New York Central and Hudson River Railroad, 25 miles north of the city hall, New York. The Yorktown campaign was outlined and planned here by Generals Washington and Rochambeau in the Livingston manor house, and in the same place, in 1783, took place the conference between Clinton, Carleton and Washington. The first salute fired by a British war sloop to the American flag was given opposite this place. At present Dobbs Ferry is mainly a fashionable residential suburb of the metropolis. It is pleasantly situated at the widest part of the Hudson River, called the Tappan Zee. It is the seat of the Masters School for Girls, Saint Christopher's Home for Boys and Girls and the New York Juvenile Farm. It has also a hospital, public playground and a public library. The name is derived from a Swede, Jeremiah Dobbs, whose family for over a century maintained a ferry here. Pop. 3,455.

DÖBEREINER, dė'bē-rī-nėr, **Johann Wolfgang,** German chemist: b. Hof, Bavaria, 15 Dec. 1780; d. Jena, 24 March 1849. He was professor of pharmacy and chemistry at Jena for 39 years, and discovered the combustibility of platinum, the apparatus for utilizing which is known as Döbereiner's lamp (q.v.). He published 'Zur Pneumatischen Chemie,' and other works. His correspondence with Goethe and Charles Augustus of Weimar appeared in 1856.

DÖBEREINER'S LAMP, a contrivance for producing an instantaneous light, invented by Professor Döbereiner, of Jena, in 1824, and in wide use before the introduction of the sulphur match. The light is produced by throwing a jet of hydrogen gas upon recently prepared spongy platinum, whereupon the metal instantly becomes red hot, and then sets fire to the gas. The action depends upon the readiness with which spongy platinum absorbs gases, more especially oxygen gas. The hydrogen is brought into such close contact with oxygen (derived from the atmosphere) in the pores of the platinum that chemical union, attended with evolution of light, takes place.

DOBRITCH, dōb'rich, Bulgaria, town situated 26 miles north of Varna, formerly called Bazarjik. It contains a mosque and a number of churches. It was twice captured by the Russians, in 1774 and 1810. An important fair is held here annually. Pop. about 15,000.

DOBRIZHOFFER, dō'brĭts-hōf-ėr, **Martin,** a Jesuit missionary to the native tribes of Paraguay and author of a voluminous and celebrated memoir on the Abipones, a Paraguayan tribe: b. Gratz, Styria, 7 Sept. 1717; d. Vienna, 17 July 1791. At the age of 19 he entered the Jesuit order and in 1749, having been ordained priest, was assigned to the mission of Paraguay, in which he spent 18 years. On the expulsion of the Jesuits from the Spanish possessions in 1767 he returned to Austria, where he passed the remainder of his life, devoting his leisure to writing his memoir 'Historia de Abiponibus, etc.,' or in its English title, 'A history of the Abipones, a cavalier and warlike people of Paraguay, enriched with copious observations on the barbarous natives, rivers, beasts, amphibia, insects, principal serpents, fishes, birds, trees, plants and peculiarities of the said province.'

A translation of the work (somewhat abridged) by Sara, S. T. Coleridge's daughter, was published in three large volumes (1822).

DOBROLYUBOV, dō-brō-lyoo'bŏv, or dŏb-rŏl'yu-boff, **Nikolai Alexandrovich,** Russian critic: b. Nizhni Novgorod, 24 Nov. 1836; d. 1861. At the age of three he knew by heart several fables from Krylov's collections. At school he was considered as an *enfant prodige* and at home he spent all his time in the library of his father in which were many books on science and art. At the age of 13 he wrote several original poems of considerable merit and translated into Russian verse some of Horace's best poems. Owing partly to the influence of his father (a parish priest) and partly to his own inclination to religion he became greatly devoted to the Christian faith and the Orthodox Church, which love he showed by a rough asceticism. During his studies at the University of Petrograd in 1854 Dobrolyubov lost in a rapid succession his parents and a sister. Poverty and sorrow delayed his literary career until 1855, when he abandoned poetry and, aided by Chernyshevski, wrote for *Sovremenik* several essays in prose which astonished the critics by their manifestation of deep erudition. His stories 'Donos' ("Report") and 'Dyeletz' ("The Versed") had a great success and improved considerably his financial affairs. Having lost all his dear ones, his heart, refined by suffering, became (1858) an easy prey to the eyes of a beautiful, chaste but extremely carelessly educated girl with whom he lived for some time, but from whom he had to separate on account of her vulgarity. However, he never forgot the good in that woman and under great strain he sent her at regular intervals pecuniary aid until her death. After this he had several other unfortunate love affairs which convinced him that his peace lay only in literature, and, indeed, until 1860 he was extremely busy writing criticisms on novels, plays, stories, etc., for the leading periodicals of the capital. All his brilliant criticism carries the seal of the spirit of the sixties in Russian literature which was then in a transient state from Hegel's metaphysics to the realism of the English and French philosophers, from mystic dualism to plain monism and utilitarianism. His critical studies, 'The Dark Czardom,' 'Spark of Light in the Dark Czardom,' 'When will the To-Day come?' etc., exhibit a powerful realism, deny the theory of nationalism in literature and contain a deep and universal analysis of the most essential sides of the Russian life.

DOBRUDJA, dō-brū'ją, or **DOBRUDSCHA,** Rumania (the ancient Scythia Minor), territory forming the southern division of the kingdom. Its boundaries are the river Danube on the north, Bulgaria on the south, the Black Sea on the east and the Danube on the west. Until the Treaty of 10 Aug. 1913, signed at Bucharest, its area was only 6,000 square miles, but at that time it received an addition of 3,508 square miles. It has a mixed population of Bulgarians, Circassians, Greeks, Roumanians, Tartars, Armenians, Jews and Turks, numbering in all about 500,000, of which about 200,000 came with the new territory in 1913. Until 1878 the Dobrudja formed part of Bulgaria. An exceedingly fertile region it has always produced quantities of cereals, beets, grapes, forage crops and tobacco; agriculture being the main industry of the people.

DOBSCHÜTZ, dop'shuts, **Ernst von,** German Biblical scholar: b. Halle 1870. He was educated at Leipzig, Halle, Berlin and Jena, and in 1899–1904 served as professor extraordinary at the last-named institution. In 1904 he was appointed to a chair at Strassburg, in 1910 at Breslau and in 1913 became professor of New Testament exegesis at Halle. He has published several authoritative works dealing with the history of the apostolic age. These include 'Kerygma Petri' (1893); 'Studien zur Textkritik der Vulgata' (1894); 'Die urchristliche Gemeinde' (1902; Eng. trans., 'Christian Life in the Primitive Church,' 1904, probably his greatest work); 'Probleme des apostolischen Zeitalters' (1904); 'Das apostolische Zeitalter' (1905; in Swedish, English and French translations); "Thessalonians" in Meyer's 'Kommentar' (7th ed., 1909); 'The Eschatology of the Gospels' (1910); 'Das Decretum Gelasianum' (1912); 'The Influence of the Bible on Civilization' (1914).

DOBSON, Henry Austin, English poet: b. Plymouth, 18 Jan. 1840. From 1856–1901 he held an official position at the Board of Trade. His earliest verses first appeared in the magazine called *St. Paul's* and were subsequently published in book form under the title 'Vignettes in Rhyme' (1873). Since then he has published several other volumes of verse, including 'Proverbs in Porcelain' (1877); 'Old World Idylls' (1883); 'At the Sign of the Lyre' (1885); 'Collected Poems' (1897); 'Carmina Votiva' (1901). Among his prose works may be mentioned his Lives of Fielding (1883); Steele (1886); Hogarth (1879); Goldsmith (1889), and Horace Walpole (1890); critical biography of William Hogarth (1891); 'Thomas Bewick and His Pupils' (1884); 'Four Frenchwomen' (1890); three series of 'Eighteenth Century Vignettes' (1892–96); 'A Paladin of Philanthropy' (1899); 'Sidewalk Studies' (1892). Many of his poems are written in various French forms, such as the triolet, rondeau and ballade, and all are marked by gracefulness, ease and meticulous finish. The atmosphere of the 18th century hangs like a garment over his most characteristic work, both in prose and verse.

DOBSON, William, English portrait painter: b. London 1610; d. Oxford, 28 Oct. 1646. Having acquired considerable skill as a painter he came under the notice of Van Dyck, who introduced him to Charles I. On the death of his patron he succeeded him as sergeant-painter to the king. Among his portraits are those of himself and his wife, Sir Charles Cotterell, Sir Thomas Browne's family, the first Duke of Newcastle, the Marquis of Montrose, Fairfax and Old Parr; and in addition there are other pictures by him, the chief being 'The Beheading of St. John.'

DOBSON, the larva of the great neuropterous hellgrammite-fly (*Corydalis cornutus*), common all over temperate North America. The adult is among the largest of insects, its papery wings spreading more than four inches; and it is dull brown in color. The female has strong biting jaws; and in the male these are extended into long, curved instruments that

look like formidable pincers, but are harmless, for they are used only in holding the female during the mating process. These insects frequent swift-running streams and rarely fly abroad in the daytime. In midsummer the female lays about 3,000 whitish eggs set on end in roundish patches the size of a cent-piece, glued to leaves overhanging water, or on rocks near its surface. The eggs soon hatch, and the minute larvæ drop into the water, descend to the bottom and creep under stones, etc., where they cling to some firm object by claw-like appendages at the hinder end of the body. By preying on everything that can be caught they grow rapidly into powerful, tough-skinned, creeping marauders two inches in length. These are much sought after by anglers for bait, and are known by many names, as dobson, hellgrammite, crawler, water-grampus, hell-devil, alligator, etc. This aquatic life lasts for 2 years and 11 months. The dobson then leaves the water and crawls about on land, seeking a suitable place for pupation; this occurs usually in May, and a month later the fly emerges and spends its few weeks of life in securing and fertilizing a mate, which lays her eggs and then dies. Consult Howard, 'Insect Life' (New York 1901).

DOCE, dō'sā, a river of Brazil, rising by several streams on the eastern slopes of the Sierra de Mantiqueira in the state of Minas Geræs and flowing to the Atlantic, which it enters about 30 miles northeast of Santa Cruz. It is about 600 miles long and is navigable up to 120 miles from its mouth.

DOCEN, dō'tsen, **Bernhard Joseph,** German philologist: b. Osnabrück 1782; d. 1828. He studied under Heyne at Göttingen, and also at Jena. In 1804 he began his connection with the State Library at Munich and in 1811 was made its custodian. Docen made a critical examination of the Old and Middle High German manuscripts, which the secularization of the Bavarian cloisters caused to be deposited under his care at Munich. Docen was the first scholar to show the importance of the old glosses in Latin and German and the glosses in Latin works of the period from the 8th to the 12th century as a groundwork for a thorough study of the modern German language. Docen was a member of the editorial staff of the 'Museum für altdeutsche Litteratur und Kunst' (2 vols., Berlin 1809–11). His published works include 'Miscellaneen zur Geschichte der deutschen Litteratur und Kunst' (2 vols., Munich 1807–09).

DOCENT, dō-tsent', in America, a term indicating a member of the teaching staff of the lowest grade. In the University of Chicago it is the rank next above that of fellow. In some other institutions it indicates the highest formal academic honor, e.g., Clark University. In Germany the docent is a teacher with full official relations and the term is used in a general sense to include professors of all grades.

DOCETÆ, dō-sē'tē, sectaries who held the human nature of Christ to be an illusion, phantasmal and not real. The word is from the Greek verb δοκέω, to appear, to seem. The Docetæ were adherents of the Gnostic school and their peculiar dogma was held by a swarm of Oriental sects which preceded and outlived Arianism, both in the East and West. Their denial of the real humanity of Christ was made on the same ground on which Cerinthus (q.v.) denied that the universe is the creation of the principle of all good. That this view prevailed among sects in apostolic times is inferred from a passage in the first epistle of Saint John: "Every spirit which confesseth that Jesus Christ is come in the flesh is of God; and every spirit which confesseth not Jesus is not of God."

DOCHMIOSIS. See Hookworm Disease.

DOCK, a name applied to a large section of the genus *Rumex,* belonging to the buckwheat family (*Polygonaceæ*), chiefly those that are not acid. These are large perennial herbaceous plants, with stout roots, alternate, ovate and often entire leaves, and bearing panicles of small greenish and usually perfect flowers in whorls. Their roots have an acrid taste, are astringent and styptic and were used in medicine until stronger remedies took their place. The root of the water-dock (*Rumex aquaticus*) makes a black color in a solution of sulphate of iron. This plant was greatly venerated by the Druids, who attributed to it miraculous qualities. Numerous species of this genus are known, some widely distributed over the northern hemisphere, 22 species being known in eastern and northern America. One variety, introduced by European settlers, was known among the Indians as "the white man's foot."

DOCK WARRANT, a species of warehouse receipt given by a dockowner to the owner of goods specified in dock warrant, and engaging to deliver them to owners or assignees. The Factor's Act in England has placed dock warrants on the same footing as bills of lading, and in many States of the American Union they have been declared negotiable by statute.

DOCKET, or DOCQUET (from "dock," to cut short, to abridge), in law, a term indifferently used for a summary of a larger writing; a small piece of paper or a formal record of judicial procedure; parchment containing the heads of a writing; an alphabetical list of cases in a court; or a catalogue of the names of the parties who have suits depending in a court.

DOCKS. See Harbors, Docks and Breakwaters.

DOCTOR, a term meaning teacher, or instructor, applied by the ancient Romans to those who delivered public lectures upon philosophical subjects. In the Middle Ages, from the 12th century, it came into use as a title of honor borne by men of great learning, as by Thomas Aquinas (Doctor Angelicus), Duns Scotus (Doctor Subtilis), Roger Bacon (Doctor Mirabilis), Bonaventura (Doctor Seraphicus) and other distinguished schoolmen. It was first made an academical title at the University of Bologna, in Italy, which received from the emperor the right of appointing *doctores legum* (doctor of laws). The University of Paris followed in 1145. Soon after the popes granted the universities the right of appointing *doctores canonum et decretalium* (teachers of the canon law); and when the study of the civil law came to be combined with that of the canon law, the title was changed to *doctor utriusque juris* (that is, teacher of both laws). The faculties of theology and medicine followed that of law in conferring this title. In the universities of Ger-

many the title of Doctor of Philosophy (Ph.D.) is that which regularly corresponds to M.A. in Great Britain and in America, the philosophical faculty corresponding to the faculty of arts. The degree of Bachelor is subordinate to that of Master and Doctor. The degree of Doctor is either conferred publicly, with certain ceremonies, or by diploma. In many cases it is merely an honorary degree, in other cases it is conferred after examination or when the person receiving it has presented a sufficient thesis on a subject connected with the branch of study to which the degree distinctively belongs. In Great Britain and the United States the degrees of D.D. (Doctor of Divinity), LL.D. (Doctor of Laws) and M.D. (Doctor of Medicine) have long been conferred, the first two being generally honorary. At some of the universities the degrees of D.Lit. (Doctor of Literature) and D.Sc. (Doctor of Science) have been instituted in comparatively recent times, at some also that of D.Phil. (Doctor of Philosophy). The degree of Doctor of Music is conferred at the universities of Oxford, Cambridge, Dublin, London and Edinburgh. The degree may be honorary or conferred after examination. See UNIVERSITY; DEGREE, ACADEMIC; and consult the authorities there referred to; consult also Denifle, 'Die Universitäten des Mittelalters bis 1400' (Berlin 1885); Rashdall, 'Universities of Europe in the Middle Ages' (Oxford 1895). Curious accounts of the revelry attending the ceremony of conferring degrees at Oxford will be found in Anthony à Wood's 'History and Antiquities of the University of Oxford' (London 1796).

DOCTOR ANGELICUS, or ANGELIC DOCTOR, a title bestowed by common consent of the scholastic divines, and ratified by the moderns, upon Saint Thomas Aquinas. See AQUINAS, THOMAS; DOCTOR OF THE CHURCH.

DOCTOR JEKYLL AND MR. HYDE, The Strange Case of. Robert Louis Stevenson's powerful allegory of dual personality, 'The Strange Case of Dr. Jekyll and Mr. Hyde,' has created so enduring an impression that "Jekyll" and "Hyde" have become proverbial symbols of the good and the evil in human nature.

Dr. Jekyll, through the agency of a drug, is enabled to assume at will a dwarfish, repulsive form embodying all the evil in his nature, so that in this shape, under the name of Edward Hyde, he may indulge his baser desires. A renewal of the same potion enables him to reassume the tall form of the benevolent physician, dominated by the better side of his personality — until the failure of the supply of the drug leads to the inevitable catastrophe.

The inception of the tale is traced to Stevenson's recollections of nursery traditions of the notorious Deacon Brodie, who was a respectable artisan by day and a burglar by night, supplemented by later reading of articles on subconsciousness. But the story actually shaped itself in a terrible dream while the author was suffering from a hectic fever. In three days Stevenson had written a first draft of 30,000 words, only to burn it and to complete the final version in three days more. The story, published in January 1886, in paper covers, had a sale of nearly 40,000 copies in six months in England alone, and was made the subject of sermons and editorials. It was extensively pirated in the United States, where, however, further popularized by three dramatizations, it made the author's reputation. In a letter to Stevenson, John Addington Symonds doubted "whether anyone had the right so to scrutinize the abysmal depths of personality"; adding, however, "The art is burning and intense. The Peau de Chagrin disappears, and Poe's work is water. Also one discerns at once that this is an allegory of all two-natured souls who yield consciously to evil. Most of us are on the brink of educating a Mr. Hyde at some epoch of our being."

DOCTOR SYNTAX, The Three Tours of, a series of three books (published 1812, 1820, 1821) by William Combe, written in verse and depicting the adventures of a certain Dr. Syntax, clergyman and teacher, who, on his horse Grizzle, sets out in the first book "in search of the picturesque"; in the second, in search of consolation; and in the third, in search of a wife. The three books were published together in 1826. The work is marked by mild satire, and describes many well-sketched types of character and class.

DOCTOR OF THE CHURCH, a name given to certain eminent churchmen. Benedict XIV gave as the things required to make a man a Doctor of the Church: first, learning so eminent as to fit him to be a doctor in the Church and a doctor of the Church; second, heroic sanctity; third, the title must be conferred by a declaration of the Pope or of a general council. The third has not always been insisted upon. In canon law four Doctors of the Church are named: Jerome, Gregory, Ambrose, Augustine. Others are called doctors without the formal declaration of Pope or council: Chrysostom, Gregory Nazianzen, Anselm, Isidore, Peter Chrysologus, Hilary, Athanasius and Basil have not the full office proper to doctors. Others who have been added by declaration of popes are Saint Thomas Aquinas, Saint Bonaventura, Saint Leo, Saint Bernard, Saint Alphonsus Liguori and Saint Francis de Sales.

DOCTOR-FISH. See SURGEON-FISH.

DOCTORS' COMMONS, in England, the popular name for the courts and offices formerly occupied by the body incorporated in 1768 under the title of "The College of Doctors of Law exercent in the Ecclesiastical and Admiralty Courts." This body took the place for older institutions of Doctors' Commons, founded in 1568, the buildings of which were destroyed in the Great Fire of 1666 and rebuilt in 1672. The buildings were situated on the east side of Saint Paul's churchyard. The college consisted of a president (the dean of the arches for the time being), and of those doctors of law who, having regularly taken that degree in either of the universities of Oxford or Cambridge, and having been admitted advocates in pursuance of the rescript of the archbishop of Canterbury, had been elected fellows of the college in the manner prescribed by the charter. They formed a distinct legal profession, the advocates holding a position equivalent to attorneys and the proctors to that of solicitors. The term commons refers to the meals, taken together in a common dining-room. The Court of Arches (the appellate court of the archiepiscopal province of Canterbury) was the principal ju-

dicial body meeting here. After the passing of laws in 1857 which made many legal reforms possible the charter of this college of doctors was surrendered, the property sold, the corporation dissolved and the courts are merged with others, and are now open to all members of the bar.

DOCTRINAIRES, dŏk-trę-nārz', a term applied to theorists or theoretical politicians. The name had its origin in France in 1815. After the second restoration of the Bourbons a small number of deputies would neither rank themselves among the friends of absolute power nor among the defenders of the Revolution. They supported Decazes while he was minister; and several of them held offices in the ministry, as, for instance, the councillors of state, Camille Jordan and Royer-Collard. Their system embraced a constitutional monarchy on the British model with parliamentary control, allowing the government more power than the ultra-liberals would admit; and, on the other hand, restricting the royal power more and admitting less approach toward the old form of government than the ultra-royalists demanded. They retired with Decazes, became merged in the Orleanists in 1830, and after the Revolution of 1848 ceased to exist as a political force. The first orator among them was Royer-Collard; they drew part of their inspiration from Talleyrand and Montesquieu, and their most distinguished writer out of the Chamber was Guizot. The 'Journal des Débats' was their principal organ. They received the name of *doctrinaires* because they were looked upon more as theoretical than practical politicians.

DOCTRINE. See CHRISTIAN DOCTRINE, DEVELOPMENT OF.

DÓCZI, dō'tsē, **Ludwig von,** Hungarian author: b. Odenburg 1845. He was educated in Vienna and Budapest, became a journalist and in 1867 entered the office of the Austro-Hungarian Ministry of the Interior. Sometime afterward he became a councillor in the Ministry for Foreign Affairs. He has published 'Utolsó prófétā' (1868) and 'A Csók' (The Kiss 1871), two dramas, also several prose works and some poems. He translated the first part of Goethe's 'Faust' (new ed. 1878) into Hungarian and also Schiller's poems (1903–05).

DOD, Daniel, American mechanic: b. Virginia, 28 Sept. 1788; d. New York, 9 May 1823. He was educated at Rutgers College. He devoted himself to the study of steam machinery and the construction of steam-engines; the *Savannah* (1819), the first steamship to cross the Atlantic, had an engine of his construction. He was killed by the explosion of a boiler on a steamboat, the machinery of which he had altered.

DODD, Frank Howard, American publisher: b. Bloomfield, N. J., 12 April 1844; d. New York, 10 Jan. 1916. He prepared at Bloomfield Academy to enter Yale, but instead went into the New York publishing house of his father, M. W. Dodd. To this business he succeeded in 1870, forming a partnership with Edward S. Mead. Six years later Bleecker Van Wagenen joined the firm and the name was changed to Dodd, Mead & Company. Beside publishing books in all departments of literature, the firm, under Mr. F. H. Dodd's supervision, founded the *Bookman* in 1895 and in 1902 the 'New International Encyclopædia' which succeeded the 'International Cyclopædia' of earlier years. Mr. Dodd was president of the American Publishers' Association for a number of years and had various civic and philanthropic interests, being largely instrumental, as president of the Fourth Avenue Association, in the business development of that street.

DODD, Walter Fairleigh, American educator: b. Hopkinsville, Ky., 7 April 1880. He was graduated from Florida State College in 1898. In 1905 he took the degree of D.Ph. at the University of Chicago. In 1904–07 he was in charge of the section of foreign law in the Library of Congress. He held a research appointment at Johns Hopkins in 1908–10, in 1910–11 was associate in political science, in 1911–14 assistant professor, and in 1914–15 associate professor of political science in the University of Illinois. Since 1915 he has been associate professor of political science in the University of Chicago. He has published 'Modern Constitutions' (2 vols., 1909); 'Government of the District of Columbia' (1909); 'Revision and Amendment of State Constitutions' (1910), also contributions to legal and other technical journals.

DODDER, a genus of plants, *Cuscuta,* of the family *Custcutaceæ.* The characteristics of the group are filiform twining stems, parasitic on other plants, to which they attach themselves by suckers. They have lost all trace of leaves, even the cotyledons of the embryo being no longer distinguishable, while chlorophyll is almost completely absent. In one American species a slight trace of coloring matter has been noticed. The seed germinates very late in spring, and as the seedling rises from the ground a yellow or pink stem soon begins to show the sweeping movements of circumnutation of a climbing plant. If no plant known as the "host" is in the neighborhood for it to take up its quarters on, it falls to the ground, but retains its vitality for some weeks, by which time a victim may probably have germinated. As soon as it touches a living plant it twines firmly round it, and a series of small wart-like adventitious roots (*haustoria*) are developed, from the centre of each of which a bundle of suctorial cells force their way through the epidermis and cellular envelope into the bast and press against the woody tissue of the host. The portion of the dodder stem below this attachment now dies off and there is then no longer any connection with the ground. The growing point again circumnutates until it finds a new base of attachment upon the same or a different stem of the host, there to repeat the formation of suckers. In this way a tangled skein of threads is formed, over which, late in the season, the yellow or white flowers develop in dense clusters and the black seeds are shaken out of the capsule by the wind or gathered with the crop. This parasite in often very injurious, fields of flax, clover and lucerne sometimes showing well-marked patches completely desolated by the pest. These have to be mowed down and burned before new seed has set; while pains must be taken to procure seed free from those of the parasite. Preventive measures are, to make careful examination of the

seed (see SEED TESTING), rejecting any that contains dodder seed and any produced upon land known to be infested by dodder. When observed growing among a crop, frequent hoeing and burning are often satisfactory. Pasturing with sheep confined to the infested patches is also practised, the animals being kept for several weeks upon the land and given extra food if necessary. The most satisfactory treatment, however, is clean cultivation or the growing of a crop upon which the dodder cannot grow. There are about 100 species of dodder of wide geographic distribution, of which at least 25 are found in the western and southern parts of North America. The temperate species are all annual, but some of the tropical species are perennial. A common American name is tangle-weed. It is a remarkable circumstance that *Cassytha,* a totally unrelated Oriental genus of *Lauraceæ,* has not only assumed the same general mode of life, and the twining, leafless habit, but germinates and penetrates in a precisely similar way.

DODDRIDGE, Philip, American lawyer and statesman: b. Bedford County, Pa., 1772; d. 19 Nov. 1832. His English ancestors had settled in New Jersey. His father had married in Maryland in 1765 and soon thereafter settled near Middletown, Washington County, which at that time was claimed under the jurisdiction of Virginia. In 1789, young Philip was placed in school at Charlestown (now Wellsburg), W. Va. Soon thereafter he worked his way down the Ohio and the Mississippi as a laborer and super-cargo on one of the numerous flatboats. In 1797 he was admitted to the practice of law in Brooke County, and after a trip to Lancaster, Pa., to get married, he made Wellsburg his permanent home. In his practice of law, which extended to all northwestern Virginia, he was greatly aided by the endless litigation resulting from the confused and complicated character of land titles. Always interested in public affairs, he took an active part in politics. He was a member of the house of delegates of the Virginia legislature 1815–16 and 1822–23. Against the arbitrary and oligarchical principles of the aristocratic tide-water politicians he began an opposition which he never relaxed. He took a leading part in the remarkable Virginia Constitutional Convention of 1829–30 which was called to amend the State constitution and over which ex-President James Monroe presided. In the numerous debates, he urged a more equitable basis of representation and suffrage, periodical appointment of the governor, selection of county courts independent of the legislature and other reforms. In 1829 he was elected to Congress and continued to serve until his death. He was active in opposing an attempt to annul the control of the Supreme Court over State courts, which he regarded as equivalent to a motion to dissolve the Union; and he obtained a wide reputation through a speech which he made in favor of parliamentary privileges in the case of the arrest of Sam Houston. His last public service was performed as chairman of a committee to draft a code of laws for the District of Columbia. He was buried in the Congressional Cemetery at the seat of government.

DODDRIDGE, Philip, English Non-Conformist clergyman and author: b. London, 26 June 1702; d. Lisbon, Portugal, 26 Oct. 1751. He determined to enter the Non-Conformist ministry and was educated at a theological academy at Kibworth, Leicestershire. In 1723 Doddridge became pastor of the dissenting congregation at Kibworth. After declining several invitations from congregations whose rigid ideas of orthodoxy he felt would be uncongenial to him, he established a dissenting academy at Market Harborough in 1729, removing as minister in the same year to Northampton. Here he continued to preach and train young students for the ministry till shortly before his death. Doddridge was at once liberal and evangelical, and with all his religious earnestness and enthusiasm had humanity enough for such levities as cards and tobacco. He strove earnestly for unity among the dissenting bodies. His principal work is 'The Rise and Progress of Religion in the Soul' (1745), which has been translated into Dutch, German, Danish, French, and even Syriac and Tamil. Besides this may be mentioned 'The Family Expositor' (1739–56); his 'Course of Lectures,' delivered to the students under his charge, and published (1763); and a great variety of sermons on miscellaneous religious topics. His hymns, nearly 400 in number, have carried his name over the English-speaking religious world, perhaps the best known being 'Hark, the Glad Sound, the Saviour Comes'; and 'O God of Bethel, by Whose Hand.' His 'Correspondence and Diary' appeared 1829–31. Consult Orton, 'Life of Doddridge' (1766); Stanford, 'Life of Doddridge' (1880).

DODDS, Alexander, American editor: b. Allegheny, Pa., 5 April 1874. He was graduated from Duff's College, Pittsburgh, Pa., in 1890 and has since been engaged as newspaper writer and editor on various journals. In 1894–96 he was associate publisher of *The Builder,* Pittsburgh, in 1902 was night editor of the Pittsburgh *Dispatch,* in 1902–04 associate publisher of the *Telegraph,* Sharon, Pa., and in 1905–08 night editor of the *Gazette Times,* Pittsburgh. In 1908–14 he was managing editor of the *Christian Science Monitor,* and since 1914 managing editor of the Los Angeles *Herald.*

DODECAHEDRON, dō-dĕk-ą-hē'drŏn, a regular solid bounded by 12 equal and regular pentagons, or having 12 equal bases. A solid having 12 faces.

DODECATHEON. See COWSLIP.

DODGE, Charles Richards, American textile fibre expert: b. Covington County, Miss., 17 July 1847. He was educated at the Sheffield Scientific School of Yale and was assistant entomologist in the United States Department of Agriculture 1867–77, editing *Field and Forest* 1874–77. From 1890–98 was in charge of the fibre investigations of that department, when he published 20 special reports, including 'A Descriptive Catalogue of Useful Fibre Plants of the World.' Officially connected with 11 international expositions, serving as a member of the jury of awards. He received the cross of the Legion of Honor of France in 1901.

DODGE, Cleveland Hoadley, American merchant: b. New York, 26 Jan. 1860. He is a son of William E. Dodge, was graduated at Princeton University in 1879. He became a director of several banks, insurance companies,

railroads, mining companies, etc., treasurer of the El Paso and Southwestern Railroad and vice-president of Phelps, Dodge & Company. He was elected president of the board of trustees of Robert College, Constantinople, is vice-president of the Museum of Natural History, New York, and trustee of the Carnegie Institute, Washington, D. C., and of the New York Public Library.

DODGE, Francis Safford, American soldier: b. Danvers, Mass., 1842; d. 1908. He saw service during the Civil War, after which he entered the regular service as first lieutenant of the Ninth Cavalry. In 1880 he was transferred to the paymaster's department with the rank of major. He was promoted to be paymaster-general, with rank of brigadier-general, in 1904. He was retired in 1906. In 1870, with four troops of the Ninth Cavalry, Dodge destroyed a large Indian camp in the Guadelupe Mountains. In 1879, with Troop D of the same regiment, he made a forced march of 100 miles to the relief of Maj. Thomas T. Thornburg, whose force the Indians threatened to annihilate near Mill Creek in western Colorado. Dodge and his troop of colored cavalrymen fought their way through the Indians, joined Thornburg and enabled him to hold the enemy at bay until re-enforcements arrived. For this he was awarded the congressional medal of honor and brevetted major.

DODGE, Grace Hoadley, American educator and social betterment leader: b. New York 1856; d. 27 Dec. 1914. She was a sister of Cleveland H. Dodge (q.v.). For over 30 years she was deeply interested in increasing opportunities for self-supporting women. At various times she was a member of the New York School Board, treasurer of Teachers' College and president of the Working Girls' Society. Her greatest work was the unification and assured success of the Young Women's Christian Associations of the United States. She was president of its national board and member of the world's committee. She gave, about two years before her death, $350,000 for the metropolitan association and national board building of the Y. W. C. A. in New York. She edited 'Thoughts of Busy Girls' (1892) and was author of 'A Bundle of Letters to Busy Girls on Practical Matters' (1897; translated into several European tongues); and joint-author of 'What Women Can Earn' (1899).

DODGE, Grenville Mellen, American soldier and civil engineer: b. Danvers, Mass., 12 April 1831; d. Council Bluffs, Iowa, 3 Jan. 1916. He received his education at the University of Norwich, Vt., and served on the United States survey expedition on the Platte River, perhaps the earliest of its kind undertaken with the object of finding a railroad route to the Pacific Coast. In the Civil War he joined the Union forces and at its close was major-general of volunteers. He was commander of the 16th Army Corps under Sherman during the Atlanta campaign and later was placed over the Department of Missouri. He served as chief engineer of the Union Pacific Railroad from 1866 to 1870 and for the next 10 years held a similar post with the Texas and Pacific Railroad. In 1867 he was elected to Congress from Iowa and served two years. He was named chairman of a commission, in 1898, to inquire into complaints charging mismanagement and incompetency in connection with the war against Spain.

DODGE, Jacob Richards, American agricultural statistician: b. New Boston, N. H., 1823; d. 1902. He received an academic and technical education. From 1845 to 1849 he taught in Mississippi, in 1850–54 edited a paper at Nashua, N. H., and from 1857 to 1861 edited the *American Ruralist* at Springfield, Ohio. For about a quarter of a century he edited the reports of the Department of Agriculture and wrote pamphlets on rural economics. He had foreign commissions for the department in 1873 and in 1887, and in 1893 became a member of the editorial staff of the *Country Gentleman.* He wrote 'Red Men of the Ohio Valley' (1860); 'West Virginia: Its Farms and Forests, Mines and Oil Wells' (1865); 'Farm and Factory' (1884).

DODGE, James Mapes, American mechanical engineer: b. Waverly, N. J., 30 June 1852; d. 4 Dec. 1915. He was educated at Cornell University and at Rutgers College. He did much original work in improving conveying machinery and allied appliances. He was elected chairman of the Link Belt Company of Philadelphia and later president of the J. M. Dodge Company and the Dodge Cold Storage Company. In 1903 he was president of the American Society of Mechanical Engineers. He published 'The Money Value of Technical Education Training' (1903).

DODGE, Mary Abigail (pseudonym, "GAIL HAMILTON"), American author: b. Hamilton, Mass., 1830; d. there, 17 Aug. 1896. For several years she was instructor in the High School at Hartford, Conn. From 1865 to 1867 she was one of the editors of *Our Young Folks.* Besides numerous contributions to current literature, she wrote 'Gala Days' (1863); 'Woman's Wrongs' (1868); 'The Battle of the Books' (1870); 'Woman's Worth and Worthlessness' (1871); 'The Insuppressible Book' (1885); 'A New Atmosphere' (1864); 'Red-Letter Days'; 'Country Living and Country Thinking'; 'A Washington Bible Class'; 'Twelve Miles from a Lemon'; 'Biography of James G. Blaine'; 'Our Common School System.' 'Gail Hamilton's Life in Letters' was issued in 1901, and 'Chips, Fragments and Verses,' edited by H. A. Dodge, in 1902.

DODGE, Mary Elizabeth Mapes, American editor, author and poet: b. New York, 26 Jan. 1831; d. Tannersville, N. Y., 21 Aug. 1905. Her father was Prof. James J. Mapes, and she became the wife of William Dodge, a well-known lawyer, of New York, but was early widowed. From 1873 until her death she edited, with remarkable ability and success, *St. Nicholas Magazine* (New York). Her best-known work was 'Hans Brinker, or the Silver Skates' (1865), which went through many editions, was translated into five foreign languages, was crowned by the French Academy and is a recognized classic of juvenile literature. Among her other works are 'Irvington Stories' (1864); 'Theophilus and Others' (1876); 'Donald and Dorothy' (1883); 'The Land of Pluck' (1886); 'Along the Way,' a collection of poems (1879); 'When Life is Young' (1894); 'Poems and Verses' (1904). Consult the memorial article in *St. Nicholas Magazine* (October 1905).

DODGE, Richard Elwood, American geographer: b. Wenham, Mass., 30 March 1868. He was graduated at Harvard University in 1890, taught geology there 1891–94. In 1895–96 he was instructor in geology and geography, in 1896–97 associate professor of natural science, and since 1897 professor of geography at Teachers' College, Columbia University. He was assistant on the United States Geological Survey in the northeastern and southern Appalachians in the summers of 1890–95. He is the author of 'Reader in Physical Geography for Beginners' (1900); 'Dodge's Geographies' (1903); 'Dodge's Geographical Note Books' (1912), and numerous articles on the teaching of geography. He is co-author, with Kirchway, of 'Teaching of Geography in Elementary Schools'; and, with Bowman, of the English edition of Brunhes' 'La Geographie humaine.'

DODGE, Walter Phelps, American author and lawyer: b. of American parents in Beirut, Syria, 13 June 1869. He is a nephew of William Walter Phelps (q.v.). He studied in Greece and Germany, and later at Yale and Oxford. He was admitted to the London bar in 1898 and to the New York bar in 1909. Among his works are 'Three Greek Tales' (1892); 'As the Crow Flies' (1893); 'A Strong Man Armed' (1896); 'The Sea of Love' (1898); 'Piers Gaveston' (1899); 'From Squire to Prince' (1901); 'The Real Sir Richard Burton' (1907); 'King Charles I, a Study' (1912), and 'The Purple Iris' (1915).

DODGE, Kan., town, county-seat of Ford County, on the Arkansas River, the Atchison, Topeka and Santa Fe and the Chicago, Rock Island and Pacific railroads, about 150 miles west of Wichita. When first settled as a Texas cattle-shipping point the place was noted for its lawlessness. It was the centre of important lines of freighting. The business attained its maximum in 1884, when herds aggregating 800,000 cattle in charge of 3,000 men passed through Dodge from Texas on the way north. Much hunting was done in this section, for buffalo and other game were then plentiful. It is the trading centre of an agricultural and stock-raising region. It is the seat of Soule College which is under the control of the Methodist Episcopal Church; a United States land office and weather bureau and a Carnegie library. Dodge has division offices and machine shops of the Santa Fe Railroad. It owns its waterworks and has adopted the commission form of government. It was formerly known as Dodge City and was named for Gen. Henry Dodge, governor of Wisconsin Territory. Consult Wright, R. M., 'Dodge City, the Cowboy Capital.' Pop. 3,214.

DODGE CITY, Kan. See DODGE, KAN.

DODGEVILLE, Wis., city, county-seat of Iowa County, situated on the Illinois Central and the Chicago and Northwestern railroads, about 50 miles southwest of Madison. The industries of the place are chiefly those of an agricultural region, notably creameries. The lead and zinc mines nearby add to the wealth of the city. The principal industry is the making of butter and cheese. The city is named after the Territorial Governor of that name, who lived here for many years. Pop. 1,791.

DODGSON, dŏj'sŏn, **Charles Lutwidge** (LEWIS CARROLL), English mathematician and author: b. Daresbury, near Warrington, 27 Jan. 1832; d. Guilford, 14 Jan. 1898. He was graduated from Christ College, Oxford, in 1854, took orders in the Anglican Church in 1861 and till 1881 was a mathematical lecturer. His first publication was 'A Syllabus of Plane Algebraical Geometry' (1860); in the following year he issued the 'Formulæ of Plane Trigonometry' and in 1864 appeared his 'Guide to the Mathematical Student.' He still remained quite unknown to the public at large, but in the next year became famous as the author of 'Alice's Adventures in Wonderland,' which, though written for the young, has found not less appreciation among those of riper years and has been translated into many languages. Equally delightful is the continuation of Alice's adventures narrated in 'Through the Looking-glass and what Alice Found There' (1871), an exception to the common rule as to the inferiority of continuations. Both books were admirably illustrated by Tenniel. Dramatized versions by Saville Clark were put on the stage in 1886. 'The Hunting of the Snark: an Agony in Eight Fits' (1876), a fantastic narrative in verse, had by no means an equal popularity, however. Among his other works are 'Elementary Treatise on Determinants' (1867); 'Phantasmagoria and other Poems' (1876); Euclid and His Modern Rivals' (1879); 'Rhyme? or Reason?' (1883); 'A Tangled Tale' (1885); 'The Game of Logic' (1887); 'Curiosa Mathematica' (1888 and 1893); 'Sylvie and Bruno' (1889–93), and 'Symbolic Logic' (1896). (See ALICE IN WONDERLAND; THROUGH THE LOOKING-GLASS). Consult his 'Life and Letters,' edited by S. D. Collingwood (London 1898), and 'Lewis Carroll' by B. Moses (New York 1910).

DODLET, a name sometimes applied to the tooth-billed pigeon (*Didunculus strigirostris*), of the Samoan Islands.

DODO, dō'dō, or **DRONTE** (*Didus ineptus*), the name of a very remarkable extinct bird discovered by the Portuguese about 1507 on the island of Cerne or Mauritius and afterward seen there by the Dutch, both at the end of the 16th and in the beginning of the 17th century. Between 1610 and 1620 live specimens were brought to Europe for exhibition. The last authentic record shows its survival until 1681. As it was never seen after this it was deemed by some altogether fabulous; but its actual existence was completely established not only by drawings made by artists who accompanied the Dutch voyagers and preserved in Utrecht, Vienna and Berlin, but by fragments of the bird itself — among others, a foot in the British Museum, both a head and a foot in the Ashmolean Museum at Oxford and a skull at Copenhagen. Several other fragments and even entire embalmed birds reached certain of the continental museums, but seem to have been mostly lost or destroyed. In 1865 and again in 1889 large numbers of bones of the dodo were found in a marsh in Mauritius from which an almost complete skeleton has been set up in the British Museum and others distributed to various collections. The dodo had short and ill-shaped legs and feet, scarcely able to support its clumsy and almost globular body, which was about twice as large as that of a turkey; and a monstrous head which, apparently ill-attached to its body, contained an enormous mouth and

terminated in a strong hooked beak. Though covered with thick plumes it was destitute of wings sufficient for flight and had their place supplied by mere stumps or rudimentary appendages, covered with soft, ash-colored feathers intermixed with yellowish-white; the tail was composed of a few small curled feathers of the same description. Naturalists are now agreed that the dodo should be put in the order *Colombæ* (q.v.) or pigeons, of which it with one or two similarly extinct birds from neighboring islands, notably the Bourbon or Réunion dodo (*Didus solitarius*), is the representative of an extremely modified family type (*Dididæ*). The cause of the extinction of the dodo together with several of its associates in the land fauna of Mauritius is said to have been the hogs which, let loose from the ships of the early explorers, multiplied greatly and overran the island. Consult Strickland and Melville, 'The Dodo and its Kindred' (London 1848), and Rothschild's 'Extinct Birds.'

DODONA, dō-dō'nā, a celebrated town in Epirus, 11 miles west of the modern town of Janina, on a spur of Mount Tomarus, in the neighborhood of which was one of the most ancient oracles in Greece. This oracle long maintained its celebrity. It belonged to the Pelasgic Zeus, who was supposed to dwell in the stem of an oak tree. The prophetic priestesses announced the divine communications in different ways. They approached the sacred tree and listened to the rustling of its leaves; or, standing by the fountain at the foot of the tree, observed the murmuring of the water which gushed forth from the earth, and in other ways. The sanctuary at Dodona was destroyed by Dorimachus, the Ætolian general, in 219 B.C. For over 1,300 years the site of the shrine was lost to history, but following on the conjectures of Bishop Wordsworth in 1832, excavations made by Constantin Carpanos in 1878 revealed the temples of Zeus and Aphrodite, the walls encircling the town and the theatre. Consult Diehl, 'Excavations in Greece' (London 1893); Gardner, 'New Chapter in Greek History' (ib. 1892); and Wordsworth, C., 'Greece' (ib. 1839). See ZEUS.

DODS, Marcus, Scottish theologian: b. Belford, Northumberland, 11 April 1834; d. Edinburgh, 26 April 1909. He was educated in Edinburgh, and in 1858 was licensed as a probationer of the Free Church of Scotland. He was lacking in those pulpit gifts which are sometimes considered essential to success in a democratic church, and served a depressingly long probationership, preaching as a candidate for 23 vacancies before he was in 1866 ordained to Renfield Free Church, Glasgow, where he remained a power for good, especially among young men (of whom Henry Drummond was one), till appointed in 1889 to the chair of New Testament exegesis in New College, Edinburgh. Among his published works some of the most important are 'Mohammed, Buddha, and Christ' (1877); 'Handbook on Genesis' (1882); 'Parables of Our Lord' (1883 and 1885); 'Erasmus and Other Essays' (1891); 'Footsteps in the Path of Christ'; 'Christ and Man' (1909). Two volumes of his letters have been published, edited by his son.

DODSLEY, Robert, English dramatist and bookseller: b. near Mansfield, Nottinghamshire, 1703; d. Durham, 23 Sept. 1764. He became a footman, and published by subscription a volume of poems, entitled the 'Muse in Livery,' which attracted public favor, less from its intrinsic merit than from the situation of the author. His next effort was the 'Toyshop,' a dramatic satire. Pope patronized this, and through his influence it was brought upon the stage in 1735. Dodsley was enabled, by his profits as an author, and the financial assistance of Pope, to set up a bookseller's shop in Pall Mall, which ultimately proved very prosperous, and which brought him into close relationship with the literary celebrities of his time. He next wrote the farce of the 'King and the Miller of Mansfield,' founded on an old ballad, which succeeded so well that he produced a sequel to it, called 'Sir John Cockle at Court.' In 1741 he brought out a musical piece, entitled the 'Blind Beggar of Bethnal Green.' He subsequently wrote 'Economy of Human Life,' a well-known collection of moral maxims; a tragedy, 'Cleone'; and a selection of fables in prose, with an 'Essay on Fables' prefixed. He planned the 'Preceptor'; the 'Annual Register' (commenced in 1758 and still published much on the lines in which he projected it); the 'Collection of Old Plays,' which now chiefly sustains his fame as a publisher; and the 'Collection of Poems by Different Hands.' Consult paper by Austin Dobson in 'Eighteenth Century Vignettes,' 2d series, 1894; and the biography by R. Strauss (New York 1910).

DODSON, John E., American actor: b. England 1857. He studied law, but early in life went on the stage, appearing first in Manchester; he supported Charles Matthews and other star players in England; and in 1889 came to the United States with Mr. and Mrs. Kendal. His first appearance in New York was at the Fifth Avenue Theatre in 'A Scrap of Paper' in 1889; later he joined the Empire Theatre Company as leading comedian. He originated the character of Richelieu in 'Under the Red Robe,' and has taken the part of Richelieu in 'Richelieu's Stratagem,' in vaudeville and the part of John Weatherby in 'Because She Loved Him So.' Played at Drury Lane Theatre, London, 1902, as Simonides in 'Ben Hur'; appeared as star in 'American Invasion,' New York, October 1902; played Pierre in all-star cast production of 'Two Orphans,' 1904–05; created Stephen Roland in Clyde Fitch's comedy, 'The Truth'; created star rôle, Sir John Coteswold, in 'The House Next Door' at the Gaiety Theatre, New York, 1909, and played same piece for next two seasons throughout the country.

DOE, John, and **RICHARD ROE,** two fictitious personages in law who formerly appeared in a common-law suit of ejectment. The former was the plaintiff and the latter the defendant. The fiction on which their appearance was based was abolished by the Common Law Procedure Act (1852), and now accordingly they do not appear in England. In American usage, attempts have been made to substitute other names, but in proceedings where the identity of the alleged criminal is not known, or is designedly concealed for any reason, John Doe is the favorite term employed.

DOES, doos, **Jacob Van Der** ("THE ELDER"), Dutch painter: b. Amsterdam, 4 March

1623; d. 17 Nov. 1673. After study with local masters he lived in France and Italy, painting landscapes of merit, but somewhat dark and spiritless in many instances. He was more successful with animals and figures. He had two sons, Jakob and Simon, both painters of note.

DOFFER (doff, to put off), a small and slowly revolving cylinder, which strips the cotton or wool from the cards on the main cylinder of a carding machine.

DOG, a mammal of the order *Carnivora*, family *Canidæ*. The origin of the domesticated dog is unknown, but probably it is of composite descent. (See DOGS, WILD.) When the different tribes and races of men drifted about the earth's surface they took their dogs with them and no doubt breeds were mixed and races exchanged. By naturalists and writers in times gone by, dogs have been divided into groups, but for practical purposes at the present time they are divided into two classes — sporting dogs and non-sporting dogs. Controversies still rage as to the origin of certain classes of dogs, but almost all hounds that run by scent and the greyhound that runs by sight, were of Persian, or at any rate Asiatic origin. The pointer in scientific parlance is the same dog as the hound, and the setter is a large spaniel. The Molossus of the ancient Greeks may be the same as the Thibet mastiff and progenitor of the Great Dane, boarhounds, mastiffs and possibly the bulldog.

The main characteristic of the dog is his reliance on man, upon whom he looks as head of the pack.

In enumerating the breeds we have to deal with at the present day the following comprises the category as met with at the leading dog shows held under the auspices of recognized kennel clubs, or that are used in the ordinary vocations or sports of life:

NON-SPORTING DOGS.

Mastiff.	Toy Spaniel.
St. Bernard.	Japanese Spaniel.
Newfoundland.	Maltese.
Collie.	Pomeranian.
Smooth Collie.	Italian Greyhound.
Bobtail Sheepdog.	Schipperke.
Poodle.	Chow Chow.
Dalmatian.	Chihuahua.
Bull Dog.	Bull Terrier.
Pug.	Boston Terrier.

SPORTING DOGS.

Bloodhound.	Irish Water Spaniel.
Foxhound.	Clumber Spaniel.
Staghound.	Sussex Spaniel.
Harrier.	Black Field Spaniel.
Beagle.	Norfolk Spaniel.
Otterhound.	Cocker Spaniel.
Deerhound.	Bassetthound.
Greyhound.	Dachshund.
Whippet.	Fox Terrier.
Great Dane.	Scottish Terrier.
Wolfhound.	Skye Terrier.
Borzoi (Russian Wolfhound).	Irish Terrier.
Pointer.	Welsh Terrier.
Setter.	Dandie Dinmont.
Retriever.	Airedale.
Bedlington.	

The interests of the dog and its betterment in breed and those qualities that make the animal valuable are looked after by clubs and associations principally in the United States, England, France, Germany, Austria, Russia, Italy, Australia and South Africa, in which countries official shows are held at stated times and the rules governing these organizations are recognized so far as breeds are concerned by these governments. A large number of illustrated magazines and journals in all parts of the world are devoted to the interests of the canine race. The principal ones in England are *Our Dogs; Stock-keeper; Illustrated Kennel News;* and *The Field;* in the United States *Rider and Driver; Field and Fancy; Dog Fancier; The Kennel; The Sportsman's Review; Stock-keeper; The Field;* and *The Dog.*

Bloodhound.— In general appearance this noble animal impresses one as the most dignified of any dog. The head is long and clean with tremendous wrinkles and pendulous ears, the eye is small and deeply set, and shows much of the haw. The old fallacy of bloodhounds being ferocious is absurd; they hunt or trail persons by scent and on finding their quarry do not attack, but stand baying until the pursuers arrive.

Standard.— Skull long, narrow and very much peaked; muzzle deep and square; ears set on very low, thin and hanging in graceful folds close to the face; deep-set eyes, with triangular lids showing the red haw; flews long, thin and pendulous, the upper lip overhanging the lower one; neck long, with profuse dewlap; skin of face very loose and wrinkled; coat close; skin thin; shoulders deep and sloping; brisket well let down; loins broad and muscular; powerful thighs and second thighs; good legs; round feet; hocks well bent; tapering stern. Colors: black and tan, red and tan, and tawny.

Saint Bernard.— This magnificent dog takes its name from the monastery of Mount Saint Bernard, Switzerland, and is remarkable for its high order of intelligence. It was used by the monks for rescuing travelers lost in the snow. The old type which was small and somewhat plain in head is fast dying out, the present show specimens being more on the mastiff type of head.

Standard.— Head very massive and large, showing great depth from eye to lower jaw; face rather short, muzzle wide, deep and cut off square; lips hanging down well and rather loose, the stop well defined, but not too abrupt; skull massive and well rounded; eyes dark in color, of medium size, rather deeply set, the lower eyelid drooping slightly, so as to show a little of the red haw; ears rather small, lying well to the cheek, and very slightly feathered in the rough variety; nose black in color, wide and deep, legs straight, with great bone and muscle; hocks and stifle well bent; feet large and compact; body rather long, broad, straight and ribs well rounded. The coat of the smooth- or short-coated variety should be very close, thick and slightly broken-haired. In the rough variety the coat should be dense and flat, of medium length, not woolly, rather long on the neck, thighs and tail. Color and markings: orange, orange-tawny and all shades of brindle and red. The markings should be as follows: White muzzle, white blaze on face, shaded with black, black shadings on the ears, white collar round neck and white on chest, legs and tip of tail. The body may be white with patches of any of the above colors.

Great Dane.— This dog is a most symmetrical animal and the embodiment of agility and strength. They were originally used in Denmark and Germany for boar and deer hunting. They make ideal watch dogs.

Standard.— Head, which should be carried high, long and not too broad; muzzle broad, strong and blunt; eyes small, with sharp expression; neck long and arched, free from dewlap; chest moderately broad; brisket deep; loin slightly arched; shoulders sloping; elbows well under; belly well drawn up; legs straight and muscular; second thighs long and strong; feet large, well arched, and close; coat hard and dense; tail strong at root, and ending fine, carried rather low. Colors: brindle, fawn, harlequin, black, white and blue.

Mastiff.— In this old breed we have probably the most massive and ferocious looking of dogs.

Standard.— Head large and massive; skull flatly rounded; ears small; muzzle square, deep and broad; teeth level; eyes brown or hazel-colored, and wide apart; front legs straight, with great bone; chest deep; loins strong and large as possible; color, brindle or fawn; in both cases muzzle and ears black; size as large as possible, so long as symmetry is retained.

Newfoundland.— This noble dog is famed for his remarkable fearlessness of water and the readiness with which it will risk its life to save human beings from drowning. The black dog, which is spoken of as the true Newfoundland, is a trifle larger than the Landseer type, which is a black and white dog. Much controversy has taken place as to whence white markings came, some claiming a spaniel cross.

Standard.— Head broad and massive with flat skull and somewhat square muzzle; ears small and lying close to the head; coat straight and dense and capable of resisting water; tail carried gaily, but not curled over; color black, black and white or bronze; average weight, 100 pounds for dogs and 85 pounds for bitches.

Pointer.— That this breed was descended from the hound was first clearly indicated by Youatt. The disposition to point appears to be due to training, and although other dogs have been taught to point, in no case do they assume the same rigid position so notable in the pointer. This breed is marked by a compact and well-knit body, sloping shoulders, muscular limbs and beautiful action. The head is large and flat, stop well defined with a depression running from the top to occiput, muzzle long and square, with not too much lip. Colors are white with black, liver, and orange markings and solid black and liver.

Greyhound.— The English greyhound, which is of great antiquity, has been regarded by some as the ancestral stock of the majority of our domestic dogs, but this is doubtful. It is easily distinguished at a glance from all other dogs by its graceful outline and large size. Greyhounds hunt entirely by sight instead of scent.

Standard.— Head long and lean, rather wide between the eyes and flat at the top; jaw powerful, but cleanly cut; teeth level and white; eyes bright; ears small and fine in texture and rose-shaped; neck long and muscular, elegantly arched and free from throatiness; shoulders oblique and muscular; chest deep and capacious; back broad and square, rather long and slightly arched over loins which should be strong and powerful; forelegs rather long and set under dog, possessing fair amount of bone; hind quarters strong and broad across, stifles well bent, thighs broad and muscular, hocks well let down; feet round, well split up with strong soles; tail long, tapering and nicely carried; coat fine and close; color, black, red, white, brindle, fawn, blue and the various mixtures of each.

Whippet.— This breed is the result of a cross between a greyhound and a terrier, and is bred especially for rabbit coursing and racing. In the latter sport these dogs are without doubt the most speedy animals known, even exceeding the speed of the racehorse for a short distance. In outline they are identically the same as the greyhound.

Staghound.— It is a large hound, white in color with black and tan markings; the head somewhat on the pointer type, but the ears more pendulous and set lower. This breed has been used for many years in Europe for stag hunting.

Deerhound.— The Scotch deerhound is larger and more massive than the English greyhound, frequently standing as high as 28 to 30 inches at the shoulder, the body being clothed with a rough coat. Its principal use is for deer-stalking in the Highlands.

Standard.— Head long and narrow, tapering gradually from the ears; nose black (occasionally blue) and pointed; lips level; ears small, set high, carried in fold, soft and silky and free from long hair; neck long, but strong, with the nape or crest very prominent; shoulders sloping; toes close and arched; chest deep; body long, but well ribbed up; loins arched with great breadth across hips; stifle well rounded; thighs long; tail set on low, curved but not curled; coat rough and harsh on body; mane on neck and slight fringe on inside legs, on thighs and on tail. Colors: All shades from dark blue or black brindle to light gray brindle, yellow, fawn, dun and drab; white markings objectionable, but very often to be found on chest and toes.

Irish Wolfhound.— This ancient breed was famous for many years in Ireland for its great power and strength and its prowess against wolves. It has practically the same lines as the deerhound only more massive in skull and body. The colors are the same.

Borzoi or Russian Wolfhound.— Is of rather larger build than his English cousin, being covered with a wavy silk coat quite different in texture from that of the deerhound and wolfhound; the head is more domed and muzzle of the Roman nose type. It is used in Russia for hunting wolves. Colors are white with drab, fawn or brindle markings.

Italian Greyhound.— This breed is kept purely as pets and may be regarded as a miniature greyhound. The eyes are much larger and more prominent than in the large greyhound. There are several colors, among which are a golden fawn and a mouse fawn, the most valuable colors; white markings are undesirable.

English Foxhound.— The modern foxhound is somewhat smaller than the staghound and cobbier in body; the head is cleaner with more substance in the muzzle; the ears are rounded and placed much higher on the skull. The American foxhound is much the same type, but somewhat smaller and lighter built, the colors often being black and tan, showing a bloodhound cross.

DOGS

1 Smooth Fox Terrier
2 Clumber Spaniel
3 Basset Hound
4 French Bulldog
5 English Bulldog
6 Pomeranian
8 Pug
7 Boston Terrier

DOGS

1 English Setter
2 Greyhound
3 Irish Terrier
4 Great Dane
5 Poodle
6 Bull Terrier
7 Russian Wolfhound
8 Collie

Beagle.— This term is generally applied to any hound standing less than 15 inches high, although the true pure breed beagle is a distinct breed, which may be regarded as a miniature foxhound with the exception of the ears, which are more pendulous; the height varies from 9 to 15 inches. The beagle has a musical note and an acute scent as well as great perseverance in following a trail.

Setters.— The various breeds known as setters are practically large spaniels which acquired this name from being taught to crouch when marking their game.

English Setter.— It is regarded as a result of a cross between the field spaniel and the pointer, and should have a soft coat with a slight wave, but no curl in the hair. There is a great variation in color, which is valued according to the following scale: black and white ticked with large splashes, or the Blue Belton; then orange and white freckled, known as the "Orange Belton"; black and white with tan markings and black and white.

Standard.— Head long and lean with a flat skull; muzzle long and deep; lips not too pendulous; ears of moderate size, fine in texture, set on bone and well back; neck long, muscular and well set in sloping, deep shoulders; chest narrow, but deep, and ribs well sprung; loins muscular and slightly arched, with powerful hind quarters; front legs perfectly straight and feet small and firm; toes arched and close together.

Irish Setter.— Of a deep-red mahogany color, this dog is rather lighter in build than the English setter, with a narrow and slightly domed head.

The Gordon or black and tan setter is much heavier than either the English or Irish breeds, this heaviness being especially shown in the head, which is broader and deeper. The body should be massive and black with tan markings.

Retriever.— This name applies to a large dog somewhat on the order of the setter, employed for retrieving game. They have more or less Newfoundland blood in them and trace their parentage to the water spaniel or setter. The curly-coated retriever, which may be either black or liver color, is the product of a cross between the smaller black Newfoundland and the Irish water spaniel. It is characterized by the short hair of the face and the tail devoid of any fringe, although covered to within a few inches of its extremity with short, crispy curls. The hair on the body is closely and crisply curled, hence the old phrase of the "nigger coated retriever," a term used in some counties in England. The wavy or flat-coated retriever has the same outline, with the exception of the coat, which is flat and wavy, and is close to the body.

Chesapeake Bay Dog.— As the name signifies, this dog is a native of Chesapeake Bay. It resembles a dull-colored red retriever both in color, shape and size. The coat is extremely dense and absolutely waterproof. For general retrieving work in the water we know of no dog which can equal it. It has been known to work the whole day in the ice and never seems to tire.

Sporting Spaniel.— The Clumber spaniel derives its name from Clumber Park, the estate of the Duke of Newcastle, where this breed has been kept for many generations. The Clumber is distinguished by its silence when hunting and is a large, low, heavy, massive dog, with immense bone.

Standard.— Large, low, heavy and massive throughout, with immense bone; head large, with largely developed forehead; brows heavy and eyes deeply set; muzzle long and very square, with a fair quantity of lip; ears small when compared with the size of the dog, and well shaped, hanging close to the face. Color is white with lemon markings.

Field or Black Spaniel.— It is somewhat on the Clumber style, but has much more activity, a longer muzzle and cleaner head.

Standard.— Head long and lean, with a good length of muzzle, which must not be snippy; a short, coarse or clumpy head is objectionable; eyes dark; ears very low down, narrow where they leave the head, long and lobe-shaped; body large, deep, long and low; tail carried below the level of the back; legs straight, strong, short and very large in bone. Although a long, low dog, he must be active, with plenty of life, and any resemblance in shape, action or movement to the bassetthound or dachshund should be discarded.

Cocker Spaniel.— The weight of this variety of spaniel at exhibitions is usually under 26 pounds. The head is long and narrow, but not quite so lean or long as the field spaniel, the muzzle well developed and not snippy; eyes dark, and although not full or prominent, a little larger in comparison with the size of the dog than the eye of the field spaniel; ears long, and small near the head, set low, and lobe-shaped; body large, deep and round throughout, and in length much shorter than in the field spaniel; stern set low; legs powerful and straight and a little longer than the field spaniel; and coat flat and abundant, but not too long, and with plenty of feather. It should be remembered that, although a small spaniel, the cocker is a sportsman's dog, and any trace in shape, make, expression or action of the toy spaniel should be discarded.

Irish Water Spaniel.— This quaint animal is possibly the most useful all-around worker of the whole group of spaniels. The general appearance is that of a big upstanding shaggy liver-colored dog with a strong head and a distinct top-knot, a well-furnished cobby body and a rat-like tail. These dogs are especially fond of the water and good on all retrieving work.

Dalmatian.— The Dalmatian or coach dog is probably allied to the pointer. It is distinguished by the spots which are black or liver, on a white ground. Its use in England and America is essentially as a carriage dog, and it devotes itself entirely to the horse, often sleeping in the same stall. In its native country the Dalmatian is used as a pointer and is said to be staunch on game.

Standard.— Head longish, skull flat, moderate amount of stop; muzzle long and powerful; eyes medium size, and dark or light according to markings; neck fairly long and arched, no throatiness; chest very deep, not wide under; feet compact, well padded; tail smooth, slightly curved upward; coat short, hard, dense; ground color pure white; spots pure black or liver color; very decided, not intermixed; ears and tail well spotted; weight 50 pounds. The general appearance is that of a pointer.

Sheep Dog.— The Collie is essentially of Scotch origin. In appearance it is one of the most handsome of the canine race, having a well-knit frame, chest deep, but not wide; fore legs straight, hocks well bent, feet compact and strong. The head should be long, fairly narrow and flat; ears small, set well back on the head and carried semi-erect, but not pricked. Colors are black and tan, black, tan and white, sable, and sable and white.

Smooth Collie.— Is practically on the same lines as the rough collie, with the exception of the coat, which is smooth and lies very close, and the eyes, which in many cases, are china or wall-eyed, that is of whitish color.

Old English (Bobtail) Sheep Dog.— This quaint old breed is quite different in type from the other sheep dog, having a short, wide skull and very massive body, which is covered with a rough, shaggy coat, with an abrupt, or bob tail, hence the name. Is much used in England by the drovers and is locally known as the drover's dog.

Standard.— Color, any shade of blue, blue merle or grizzle, with white on face or legs for relief; head big and square; eyes small and dark; in very light-colored dogs wall or marble; square in body and as large as possible, with a broken, harsh, wavy coat; ears small and neatly set on side of head.

Bearded Collie.— Is practically a repetition of the bob-tail, with the exception of the tail, which is long and carried low, and the body, which is not quite so short or massive.

Bull-Dog.— This breed is, without doubt, the most maligned of the canine race. In appearance it is that of a low cobby dog, with a very large flat skull, showing much wrinkle, short nose or face and a long, wide turned-up under-jaw. In body is low and wide in front, with well-sprung ribs and a short roach or wheel back, and a short, tapering tail, which must not be carried above the level of the back. Since the old-time sport of bull-baiting has been done away with the bull-dog has been bred especially as a pet. They are, in no way, fighters, being, without doubt, the most affectionate of all breeds.

Standard.— Thick-set and compact; very heavy in front, and of comparatively lighter build behind; legs short, muscular and set outside the body, but not exaggerated; shoulders massive, and standing well out; chest wide and deep; skull large; and temples high, with stop well defined; eyes wide apart, and dark in color; underjaw wide, and well turned up; nose large, black and very short; strong loin, well tucked up; tail short and set on low; colors, all shades of brindle, fawn, white and all pied colors.

Terrier.— The bull terrier, as its name implies, is a cross between the bulldog and the white English terrier. The general appearance is that of a symmetrical animal, the embodiment of agility, strength and determination. The ears are cropped, which gives a smart and alert appearance. The popular color is pure white with small black eyes and nose; a cherry or flesh-colored nose is undesirable.

Standard.— Head long, flat and wide between ears, tapering to nose without cheek muscles, slight indention down face, without a stop; jaws long and very powerful; large black nose, and open nostrils; eyes small and very black; lips meeting as tightly as possible without a fold; teeth regular in shape and meeting exactly, a deviation being a great fault; ears always cropped; neck long, slightly arched, nicely set in shoulders, tapering to head, without any loose skin; shoulders strong, muscular and slanting; chest wide and deep; ribs well rounded; back, short and muscular; fore legs perfectly straight, with well-developed muscles, not "out at shoulder," and very strong in pasterns; hind legs long, muscular, and good strong, straight hocks, well let down; feet like those of a cat; color white; coat short, but close, stiff to the touch, and with fine gloss; tail set on very low, and 10 to 12 inches long, thick where it joins the body, tapering to a fine point, carried without a curl and never over the back.

Airedale Terrier.— This is a large rough-coated terrier, found chiefly in Yorkshire, England. It derives its name from the river Aire, where it is much used for all hunting purposes. The general appearance is that of a big, rough-coated dog, on the same lines as the Irish terrier, but much stronger and heavier built. The colors are black and tan, and grizzle and tan, and the weight from 40 to 55 pounds. The coat should be short, very dense and of a harsh texture.

Scottish Terrier.— The general appearance is that of a low cobby rough-coated terrier with prick ears. The head should be long and narrow, with small, dark eyes and a long punishing jaw; the front legs straight and shoulders strong but not too broad; body short and the tail carried gayly; weight about 14 to 20 pounds; colors, wheaten, red and black brindle and solid black. White markings are objectionable.

Skye Terrier.— This is undoubtedly the old Highland terrier, a long, low dog with a long, straight coat of dark steel blue or gray color; head broad and strong, with a long jaw; nose pointed and eyes small, dark and set close together; body long and low but arched at the loins, and tail carried low and ears pricked or drop, the latter carried low and close to the head.

Dandy Dinmont Terrier.— This game little terrier is also of Northern origin. It is low on the leg and strongly built. The head is apparently large in proportion to size; skull fairly wide and covered with a top-knot of silky, light hair. Colors are pepper or mustard; tail carried gayly above; weight not over 25 pounds.

Bedlington Terrier.—This breed hails from the northeastern counties of England. It is rather long and wiry in appearance, with a bluish or sand-colored coat. The head is long and narrow, with a silky top-knot somewhat like the Dandie, but is much narrower in skull. These dogs are exceedingly game and weigh 12 to 18 pounds.

Welsh Terrier.— As the name implies these little dogs come from Wales. They are in general appearance much like the Airedale and of the same color; the head is broader in comparison and eyes set wider apart. The weight should not exceed 20 pounds.

Yorkshire Terrier.— This is a small breed, bred chiefly in the county of Yorkshire, and is easily distinguished by its very long, silky coat, especially on the face, which is parted from the nose down the whole length of the body to the tail. It is exceedingly bright and quite game, but valued chiefly as a pet. The colors are a

dark blue body with tan markings, and black with tan markings. The ears are cropped and carried erect and the weight is between three and eight pounds.

Maltese Terrier.— This dog is on the same lines as the Yorkshire but a trifle larger; color pure white, with a black nose and small, deep-set eyes. The coat should be flat and not curly, which, in many cases, shows a toy poodle cross.

Manchester or Black and Tan Terrier.— A smooth-coated terrier which has been bred for many years in Manchester, England; derives its name thence. The general appearance is that of a smart dog with a black body and rich tan markings on the legs and feet; the division between the colors should be well defined. The ears are cropped or V-shaped. The weight is from 7 to 20 pounds. The toy black and tan is identically the same breed, but does not exceed seven pounds in weight.

Dachshund.— This quaint and very game breed is essentially of German origin. The general appearance is that of a dwarfy, short-legged, long-bodied but sturdy dog, with strongly developed muscles. The head is long and fairly broad, conical in shape, tapering toward the nose, with ears set high and broad and nicely rounded, not pointed or folded. The legs should be short and muscular, but not over at the knees; elbows well under and shoulders broad and well placed; loin short, firm and broad, and tail short but carried gayly. Colors are solid red, black and tan and dappled. The coat should be smooth and glossy. The rough-coated variety, which is now becoming popular, is on the same lines exactly.

Poodle.— This is probably the cleverest of all dogs and most apt to learn tricks. Its colors are a deep black, blue, red, white or cream. There are two varieties, the corded, which has a long, rope-like coat, and the curly, which should be short and tightly curled like astrakhan. They make ideal companions and can readily be broken to the gun and make grand retrievers.

Fox Terrier.— The fox terrier is probably the most popular of all terriers. It is said to have descended from a cross between the small fox hound and the English terrier. It derives its name from the use of driving foxes from holes or burrows in the ground. The most popular color is a pure white body with black and tan markings on the head with an even blaize up the face. The head should be flat and narrow, with a strong foreface or muzzle; eyes small, ears likewise small and of V shape, carried forward and close to the head. The body should be short with well-sprung ribs, narrow in chest, with clean sloping shoulders, perfectly straight front and cat-like feet. The wire-haired dog is identically the same as his smooth brother, with the exception of the coat, which should be rough with a decided harsh texture. Weight, 15 to 21 pounds.

Irish Terrier.— As the name implies is of Irish origin and is aptly named the "Dare Devil," being very game. In size it is somewhat larger than the fox terrier and more racy in body and has larger feet. Cropping the ears has now gone out of fashion, the modern ear being the same as the fox terrier.

Standard.— Head long, rather narrow, punishing jaw, eyes small and dark, ears fairly small, not set on too high, legs straight and strong, feet round and thick with good pads; chest narrow with good depth of brisket, back strong and straight. Color wheaten and red. Expression wicked but intelligent. Coat short and rough and very harsh.

Boston Terrier.— This smart little dog is especially of American origin, having been raised in Boston and the nearby towns for the past 40 years. It resembles the bull-dog in head, but is void of wrinkle and must not show the teeth; the body should be built on the terrier type, having a narrow front with strong but not wide shoulders, short back and a short screw or tapering tail. The ears are cropped and carried erect. The three classes by weight are under 15 pounds, under 23 pounds and not exceeding 32 pounds. Colors are brindle with white markings, fawn and white or red and white. They are used entirely as pets.

Pugs.— This quaint breed is one of the most popular house pets. In appearance they resemble the bull-dog, having a short, square muzzle and heavily wrinkled head. The ears should hang close to the head and be carried forward; the body be short and round, and the tail curled and lie on the back. The colors are a rich apricot fawn with black shadings and a deep black.

Toy Spaniel.— The English toy spaniels are the King Charles, or black and tan, the Blenheim or orange and white, the Prince Charles, and the Red, and are practically all of the same family, distinguished only by the colors. The head should be large and domed, with the ears set very low in the skull; the nose or face, as short as possible and stop well defined; eyes as large as possible and very prominent; body short and well coated and small in size. They are essentially house pets.

Japanese Spaniel.— It is black and white, or orange and white. The head is not so large or domed as the English spaniel and the ears are much smaller and carried higher and V-shaped; eyes wide apart and showing a good deal of the white; tail heavily coated and carried over the back. In size it is as small as possible.

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XII, New York 1899); Youatt, W., 'Training and Management of the Dog' (New York and London 1859). For diseases of the dog, see DOGS, DISEASES OF. CHARLES G. HOPTON.

DOG IN ART AND SYMBOLISM. Haydn's Dictionary says of the dog, it "was worshipped by the Egyptians and hated by the Hebrews." With the ancient Egyptians Marpi, son of the god Horus, was represented as having the head of a dog. The Oriental symbolism gives the dog a position of degradation because these animals are the scavengers living on the filth of the people and in the Eastern cities the garbage and refuse is thrown into the street for the dogs to care for. Being undomesticated, these animals run wild in packs and become often, when starving, rabid and vicious and are permitted existence by Orientals only as serving to cleanse the neighborhood of offal. Hence the mention of the "friend of man" in Holy Writ is rare and, contrary to Occidental symbolism, always made in an evil sense. We find, in ancient Roman dwellings, a chained dog depicted (generally in mosaic) and the words "cave canem" — beware of the dog — on the threshold. Assyrian sculptures are extant representing the greyhound and the mastiff. In European symbolism the dog is an emblem of fidelity and loyalty, and for this reason was placed at the feet of the effigies of married women upon sepulchres. Husenbeth says that in ecclesiastical art the following saints have been pictured accompanied by a dog: Saint Bernard (abbot) has a dog at his feet; Saint Wendelin is pictured keeping sheep, a dog at his feet, or held by a cord; Saint Benignus has a dog by his side; Saint Roch has been portrayed as a pilgrim, a dog near him with a loaf of bread in his month, or a dog licking his feet; Saint Domenic has been represented with a dog firing a globe with a torch; Saint Parthenius has been pictured killing a mad dog by the sign of the cross; Saint Godfrey of Amiens has been represented with a dead dog lying near him; Saint Sira has been pictured with dogs about her. Sirius or Canicula is known as the "dog-star" and figures in the constellation Canis Major ("larger dog"). In the Chinese zodiacal system a dog is the sign of the month of September. In ceramics the amateur collector and the auctioneer use the term "dog of Fo" to designate a fantastic animal figuring in ornament and decorative composition; but it is intended as a lion ("lion of the Korea") not a dog and is usually accompanied by a sphere. The Japanese use the device under the term *Shishi*. It is an almost necessary companion to the statue of Buddha, and in the Chinese mythology is the guardian of temples and domestic thresholds, as an emblem of peace, or tranquillity.

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DOG-DAYS (Lat. *caniculæ*), the name applied by the ancients to a period of about 40 days, the hottest season of the year, at the time of the heliacal rising of Sirius, the dog-star; that is, the time when it rose just before the sun. The heat, which is usually most oppressive at this season, was formerly ascribed to the conjunction of this star with the sun. We still retain the expression dog-days, as applied to the hottest season of the year, but owing to the precession of the equinoxes it is no longer the time of the heliacal rising of the dog-star.

DOG-FENNEL, a plant (*Anthemis cotula*) belonging to the family *Asteraceæ*. It is found in fields and waste places throughout much of North America, having been naturalized from Europe. It is known as a weed in Asia, Africa and Australia. It derives its name of dog's-fennel from the resemblance of its leaf to fennel, and from its bad smell. It has an acrid taste and emetic properties. This plant is also called stinking May-weed, the scentless May-weed, or wild camomile. The name dog's-fennel is sometimes applied in America to a species of the genus *Eupatorium*, hog-weed.

DOG-FISH, the popular name of several species of small shark (q.v.), chiefly belonging to *Mustelus* and *Squalus*, two quite unlike genera. The name is derived from their habit of swimming in schools or packs in pursuit of their food. In their general anatomy, they differ but little from the other sharks, so well known for their ferocious habits. The dog-fishes, though among the smallest of the tribe, manifest propensities equally cruel with those which have rendered the white shark and others so justly dreaded. Although seldom or never injurious to man, they commit great ravages in the fisheries, and where they abound constitute one of the greatest nuisances to the fishermen. Exceedingly voracious, and devouring almost everything which they encounter, the mischief they occasion by taking the baits, and very often the hooks, of the deep-sea lines, is very considerable and not at all compensated for by the flesh of those which are captured.

The smooth dog-fish or dog-shark (*M. canis*) is found on both sides of the north Atlantic, and on the American side is particularly abundant south of Cape Cod. It is from two to three feet long. No spines occur in the margins of the dorsal fins, and the smooth pavement-like teeth are especially adapted for crushing crabs, lobsters and other testaceous invertebrates on which they chiefly feed. The young are hatched from the egg in the oviducts of the female (with which, however, they are not connected by a placenta, as in the related *Galeus mustelus* of Europe), and are born alive. The eggs are similar to others of the family and covered by a tough membranaceous integument. The skin of these fish is beset with numerous small asperities, which render it, when dried, well adapted for polishing wood and for other mechanical purposes.

The spiny dog-fish (*Squalus acanthias*) is very abundant on the coasts of New England, and, although similar in size and general aspect, is readily distinguished from the smooth dog-fish by the presence of a strong spine before each of the two dorsal fins. The eggs are deposited before hatching. This species furnishes material for a valuable fishery and fish industry in Maine, where the oil is extracted from the livers, the flesh ground up for fertilizers or poultry food and the skin utilized for polishing metal and wood. The dog-fish feeds chiefly on herring and mackerel, the schools of which it follows in immense numbers. Similar species occur in the Pacific Ocean and other seas.

The flesh of all the species is hard, dry and unpalatable, requiring to be well soaked before

it is eaten. In England the dried flesh goes under the name of Folkestone beef. Poisonous effects are at certain times observed in consequence of eating the livers of dog-fish and some cases are recorded in which the most distressing illness has been occasioned by the practice. The name dog-fish is also applied to several other quite distinct fishes, more particularly to the western mud-fish or bow-fin (*Amia calva*), and to the dog-salmon (*Oncorhynchus keta*).

DOG-GRASS. See COUCH-GRASS.

DOG PARSLEY, one of the common names of *Æthusa cynapium,* a poisonous plant of the carrot family, the only species of the genus *Æthusa,* found in America, from Nova Scotia west to Minnesota, and south to New Jersey, having been naturalized from Europe. The fruit bears some resemblance to the fruit of dill and fennel, and is sometimes eaten in mistake for these. The sharp acrid taste marks the difference. Other names are Fool's parsley, fool's cicely and dog-poison.

DOG ROSE (*Rosa canina*), a plant of the rose family (*Rosaceæ*); known also as the canker rose, wild brier, and referred to by Shakespeare as "canker-blooms." It is a native of Europe and northern Asia. The ripe fruit is sometimes used abroad to make a preserve that is employed in the manufacture of pills. The plant is somewhat naturalized in America, and is not rare in cultivation.

DOG-SALMON, a name given on the western Pacific Coast of North America to the *Oncorhynchus,* also known as the chum salmon. The average weight is from 10 to 12 pounds. This is one of the five species of *keta,* the widely-known Pacific salmon (of which the hump-backed salmon is the smallest), which are found on the North American coasts from Alaska to as far south as Oregon or even the Sacramento River.

DOG-STAR (SIRIUS), the star that gives their name to the dog-days (q.v.); also applied to Procyon, a double star in Canis Minor. Sirius is the brightest star in the heavens, and once was thought to exercise a baleful influence upon human affairs. It is now a clear white star in the constellation Canis Major though Seneca and Ptolemy describe it as red.

DOG-TOOTH SPAR, a common variety of the mineral calcite (q.v.), so named because of the resemblance of the acute scalenohedrons, of which it is composed, to a dog's tooth.

DOG-TOOTH VIOLET, a common but erroneous name for plants of the genus *Erythronium* (q.v.).

DOGBANE, the common name of the genus *Apocynum,* a group of perennial herbs, possessing a milky acid juice. Numerous species occur in North America, the best known being *A cannabinum,* Indian hemp (q.v.), and the spreading dogbane or honey-bloom (*A. androsæmifolium*). The plants yield the acrid milky juice so common in members of the family; the root is intensely bitter and nauseous. It is the most powerful part, and is employed by country physicians instead of ipecacuanha.

DOGBERRY. See DOG-WOOD.

DOGE, dōj (Lat. *dux,* "a leader or duke"), formerly the title of the first magistrates in the Italian republics of Venice and Genoa. The first doge of Venice elected for life was Paolo Anafesto, in 697. The doge was first elected by the people, but afterward by the great council under a complicated and almost incomprehensible scheme of voting which maintained the fiction of popular election. He held his dignity for life. His power was at first almost absolute. He could convoke legislative assemblies, declare war, conclude treaties, take command of the army, appoint military officers and judges, invest bishops and award ecclesiastical penalties. But this absolute authority was by degrees entirely taken from him, and for centuries before the abolition of the dignity he had become merely a gilded figurehead, "the outward and visible symbol of the impersonal oligarchy." The dignity was abolished with the overthrow of the republic in 1797. In rank he was considered only equal to a duke, though the republic of Venice was in dignity equal to a kingdom. In Genoa the office of doge was established in 1339. Here also the doge was at first elected by the people, but the dignity afterward experienced numerous changes both in this and other respects. After the liberation of Genoa from the yoke of France by Andrea Doria the power belonging to this office was more systematically defined. A great and small council were created, and the duration of the office was limited to two years. After the overthrow of Genoa by the French in 1797 the dignity became extinct, although it was revived for a short time between 1802 and 1805. See GENOA; VENICE.

DOGE'S PALACE, The (It. *Palazzo Ducale*), the official residence of the former rulers of Venice. It was founded about 814, but was subsequently destroyed and rebuilt five times. The present edifice was begun in 1350 and completed in 1442. Its noble arcades, variegated walls of marble, and its colonnades make it one of the most beautiful and striking monuments of mediæval Europe, and adorned internally by the works of Titian, Tintoretto, Veronese and other Venetian masters. The Sala del Maggior Consiglio (Hall of the Greater Council); the Giant's Stairway, which takes its name from colossal statues of Mars and Neptune at the top; the Scala d'oro (Golden Staircase); the Scala dello Scrutino, or voting hall; and an archæological museum, are among the rare and surpassing glories of Renaissance art. A narrow passageway leads to the Bridge of Sighs (constructed in 1660). The dungeons which are now shown to visitors were those which formerly were reserved for political offenders, from which access is had to a torture chamber and a place of execution.

DOGGER (from Dutch "dogger," a cod-fish), a Dutch vessel equipped with two masts and somewhat resembling a ketch. It is principally used for fishing in the North Sea, chiefly on the Doggerbank.

DOGGERBANK, an extensive sand-bank of the North Sea, midway between England and Denmark, lying between 54° and 56° N. lat. and 2° and 5° E. long. It is 160 miles long by 70 broad, and has a depth of from 60 feet (English side) to 120 feet. It is celebrated for its cod fishery. An action was fought off the south end in 1781 between the English and Dutch fleets. On the night of 21 Oct. 1904, in a sudden panic which seized the Russian Baltic fleet under Admiral Rozhdestvensky, then on

its way to the Far East, the Hull trawling fleet was apparently mistaken for torpedo boats and fire was opened on them, in which a trawler was sunk and two men killed. The incident led to grave risk of war between England and Russia, but matters were smoothed over by means of an international commission of inquiry and the payment of compensation to the parties wronged.

DOGGETT'S COAT AND BADGE, a prize for a rowing-match on the Thames, which takes place every year on 1 August, the course extending from London Bridge to Cadogan Pier, Chelsea. The first prize is an orange-colored waterman's coat and a silver badge representing liberty, and to this have been added other prizes, the first prize being also augmented. The match is open to six young watermen recently out of their apprenticeship. It was instituted by Thomas Doggett (d. 1721), a native of Dublin, and a popular actor in the early part of the 18th century, who founded the prize in 1716 in commemoration of the accession of George I (1 Aug. 1715) and bequeathed a sum to perpetuate it, the administration of which is now in the hands of the Fishmongers' Company. Dibdin's ballad opera, 'The Waterman,' is based upon this rowing contest.

DOGMA, in the theological sense of the word, is a tenet of faith given in the word of God whether written or traditional and proposed by the Church to the belief of the faithful. Primarily the term dogma, being derived from the Greek verb δοκεω, to seem, to appear, meant only opinion; but in the ancient schools of philosophy dogmata (plural) were the doctrines of the several heads of such schools. The disciples of Pythagoras accepted on the authority of The Master, as they styled him emphatically, the tenets he proposed, the sufficient ground of the disciples' belief being that αυτος εφη "He said it." Perhaps the first employment of dogma, dogmata in the now current meaning of the word, is found in a work by Saint Ignatius, disciple of Saint John the Evangelist, who in an epistle to the Magnesians exhorts them to be "established in the dogmata of the Lord and the apostles." The dogmas of the Roman Catholic Church purport to have been taught by the apostles and to have been by them handed down *viva voce* or in writing, to their contemporaries and successors, who in turn did and still do the like: that tradition is the foundation of all the Church's articles of belief. The Church has no power to frame new dogmas and she must to the end of time proclaim the self-same dogmas which at any time in her history were authentically set forth as truths of divine revelation. What the Church may do and has done is to define, as occasion may require, the precise meaning of her teachings, bringing out into definite shape what before was not expressed with all necessary fulness or clearness. An example of this is had in the application of the term transubstantiation to signify what the Catholic Church had at all times believed and taught — that the bread and wine are, in the sacrament of the Eucharist, really and substantially changed into Christ's body and blood. Since the doctrines thus advanced are for belief and not for discussion the dogmatic method may really be considered as the expression of an opinion without advancing therefor any adequate reason or proof and without considering the viewpoint of others or the light in which it appears to them. Consult Arnold, Matthew, 'Literature and Dogma' (1873); Lightfoot, J. B., 'Commentary on the Epistle to the Colossians'; Schmidt, W., 'Dogmatik' (1895); Stange, C., 'Das Dogma und seine Beurteilung in der neueren Dogmengeschichte' (1898); Wetzer and Welte, 'Kirchenlexicon' (2d ed., 1901). See CHRISTIAN DOCTRINE, DEVELOPMENT OF; THEOLOGY.

DOGS, Diseases of. Chorea.— Chorea usually appears in dogs as an irregular jerking of the muscles of the head or some other part, or even of the entire body. In most cases medicinal treatment does not give great benefit, unless the chorea is the result of other disease. Dogs may be given Fowler's solution of arsenic, beginning with one-drop doses once daily and increased one drop a day until five to ten drops (depending on the size of the dog) are given three times daily. Simple syrup of hypophosphites should be given in teaspoonful doses three times daily with the arsenic. This treatment may be continued for two or three weeks, then stopped for a like period and then repeated.

Distemper.— Distemper is a contagious catarrhal fever that is a common and serious disease among dogs. The disease is caused by a germ and animals contract it from coming in contact with or proximity to another animal suffering from the disorder. It is thought that the germs float through the air and are inhaled by the dog. Among the conditions that favor the disease are those that tend to weaken the system. Pure-bred puppies appear to suffer greatly from it. The time that elapses between exposure and the first symptoms is seldom more than three days. When dogs are gathered at shows the disease is likely to occur, owing to exposure to infection and the unusual nervous strain. One attack usually gives immunity to future attacks. The disease is brought on with a chill that may last an hour or more. It is followed by a high fever, the dog's temperature going to 107° F. There is a slight discharge of watery mucus from the nose and eyes, that soon becomes profuse and purulent, sticking the lids together. Usually a rash breaks out on the inside of the thighs. In some cases there are nervous symptoms, shown by jerking of the head and twitching of the muscles; or the dog may become delirious. Often there is difficult breathing, with a painful cough or moan. The bowels may be constipated, or there may be a severe diarrhæa, with a fetid odor. The dog suffers greatly from prostration and dislikes to be disturbed. The disease runs its course in 10 to 30 days. There is no medicine that will interfere with its course. All the treatment should be directed toward making the animal comfortable and keeping up its strength so that it may resist the disease. Vigorous dogs of good constitution will usually recover; weak, debilitated animals are likely to be overcome by the disease or by various complications. In the early stages, castor oil in doses of half an ounce, with two or three grains of boric acid added, should be given every six hours until the bowels move thoroughly. This may be followed by two-grain doses of quinine, twice daily. The nose, mouth and eyes are to be well

washed out with warm water three times daily, and the nose and eyes greased with vaseline. The animal is to be given minced fresh beef, beef tea, sweet milk, raw eggs and gruels, and allowed what cold water it wants to drink.

There are many complications that occur with the disease: pneumonia, bronchitis, inflammation of the brain or spinal cord and paralysis, usually of the hind quarters. When the dog recovers, abscesses are likely to form in some part of the body. If these occur in the internal organs they are often fatal. Another common sequel is chorea. All infected quarters should be thoroughly disinfected and exposed to the sun and air for several weeks before allowing other susceptible dogs to occupy them.

Ectropium.— This disease is a turning out of the eyelid, usually the lower one, so that it presents a red and irritated appearance. It occurs in horses as well as in dogs but not frequently. It is usually the result of severe inflammation, or an injury. When this condition is permanent, the only treatment is to remove a V-shaped piece from the lower lid, stitching together the parts so as to bring the lid up to its normal condition.

Hydrophobia; Rabies.— Rabies is an infectious disease, originating in dogs, possibly also in wolves, cats and skunks, and by them transmitted to other animals by direct inoculation, usually by biting. Animals suffering from rabies are said to be "mad." Hydrophobia, the common name, means "fear of water," and the inference is that animals suffering from this disease are afraid of water; but this is untrue. "Mad" dogs usually crave water, but the excitement and effort of drinking are likely to cause convulsions, which have been mistaken for fear. Although rabies has been studied extensively, and an attenuated virus for preventing the disease was discovered and introduced by Louis Pasteur, the germ of the disease, if germ it be, has not been isolated. The virus exists in the saliva, as well as in some other parts of the body, and when injected into a wound is likely to cause the disease. There is less danger from being bitten when the teeth of the rabid animal are cleaned by biting through cloth or leather. There is a popular idea that rabies is most prevalent during the hot months, but statistics show that a slightly greater number of cases occur during the winter months. In the dog, rabies occurs in two forms, the dumb and the furious, the latter being the most frequently observed. The period of incubation,— that is the time that elapses after the animal or person is bitten and the appearing of the first symptoms of the disease,— varies from a few days to many months, the average being from three to six weeks. The first symptom usually seen in dogs is a dull, depressed condition. The dog crawls into obscure places and dislikes to be disturbed. He licks the original wound and the genital organs. The appetite is abnormal, the dog eating grass, sticks, dung, and the like. As the disease progresses, the dog becomes cross, snapping at space or at inanimate objects, at other animals, and at persons. A rabid dog shows a tendency to wander, often going long distances and attacking persons and animals. If confined he will bite sticks or other objects, and sometimes will tear his own flesh. In the later stages of the disease, the dog becomes exhausted, the eyes sunken, and the body emaciated. Associated with this is paralysis, particularly of the hind parts and the lower jaw, the latter condition being accompanied with a discharge of saliva. The bark of a rabid dog is peculiar,— a short bark prolonged into a whine. Death occurs from exhaustion soon after paralysis sets in.

Post-mortem examination does not give definite information. There is slight irritation of the stomach and bowels, the stomach often containing sticks and other foreign bodies swallowed by the dog during the progress of the disease. In order to diagnose suspected cases of rabies, inoculations of the cranial cavities of rabbits can be made with some of the spinal marrow from the suspected case. If the rabbit contracts rabies, the diagnosis is, of course, positive. After a dog has contracted the disease it should be put out of its misery, as there is no hope of recovery from rabies. The animal should be securely confined, as soon as suspicious symptoms develop, to prevent the possibility of its injuring anyone. A person bitten by a rabid animal should have the Pasteur treatment; the wound should be cauterized with nitrate of silver or other strong caustic, and antiseptics freely used.

Mange.— The term mange as applied to animals is identical with itch in the human race, in both of which parasitic life exists in the skin, and is purely a cutaneous disease. Dogs suffer from two varieties, namely *Sarcoptes Canis*, sarcoptic mange, and *Acarus Folliculorum*, follicular mange. So-called red mange is not due to a parasite but arises from other causes, viz., too much meat or corn-meal diet, with insufficient exercise, deranged condition of the digestive apparatus, worms, teething, sudden cooling of the body when heated, fleas, etc. The symptoms of sarcoptic mange are: intense itching, small red points appearing on the skin, which quickly develop into pustules exuding a fluid which forms scabs. When scabs are removed the hair will accompany them, leaving the parts nude. The parasite usually attacks the skin where most exposed, under the shoulders and thighs, about the hock joints, the feet and the eyes. Follicular mange also causes itching, is accompanied by a fetid body smell, the pustules sometimes discharging. It does not yield easily to treatment nor is it as easily transmitted as sarcoptic mange, the parasite being more deeply seated. Treatment of both varieties consist of preparations of mercury, such as corrosive sublimate, red or white precipitate, or ordinary mercurial ointment. Carbolic acid solutions are used. There are several mange remedies on the market into which these constituents enter.

Dogs suffer also from jaundice, pneumonia, enlarged glands canker of the ear, indigestion, rheumatism, ophthalmia, black tongue, sore feet, and fleas. For these there are the usual remedies for similar diseases in human beings, pills, liniments, fomentations, etc. Consult Barton, F. T., 'Our Dogs and All About Them' (Boston 1911); Mills, Wesley, 'The Dog in Health and Disease' (New York 1892); Shaw, Vero, 'Encyclopedia of the Kennel' (ib. 1913); Walsh, J. H., 'The Dog in Health and Disease' (London 1859).

DOGS, FOSSIL, several species are known to us in the fossil state remounting to the Eocene period, at which point the forms become so general that it is only with the greatest

difficulty that they are reduced to their proper classification. Thus in tracing back the ancestors of the dog to this period we meet the forerunners of the same family, the jackal, wolf, fox, etc., and approach closely to the ancestors of the bear. Naturalists are agreed that all these derive a common origin from the carnivores of the Eocene period.

DOGS, Isle of, a peninsula of London extending into the Thames opposite Greenwich in the borough of Poplar. It contains the West India and the Milwall docks, and large shipbuilding yards. The king's hounds were, it is said, formerly kept here, hence the name.

DOGS, Wild. Zoölogically the term "dog" refers to the family *Canidæ* (q.v.) which includes many prehistoric genera, fossil since the Miocene, and modern wolves, dogs, foxes, fennecs, jackals, South American fox-dogs and a few others. All these belong to the typical genus *Canis;* but the family also contains a series of "thooid" species of more dog-like aspect than *Canis.* They comprise the queer little raccoon-dog of China; the long-bodied, short-legged bush-dog of Guiana; the fennec-like Cape fox of South Africa; the powerful and fierce hunting-dog of central Africa, and a group of species native to eastern Asia. These Asiatic species form the genus *Cyon,* are peculiar in structure, especially as to dentition. One species is Siberian, closely resembles an Eskimo sledge-dog, except that its bushy tail does not curl; and with its compact, robust body and short muzzle it has a very dog-like aspect. It lives in forests and hunts in packs. At the other extreme is the wild dog of the Malay Archipelago, which is thinly haired and gaunt. More widely known than either of these, however, is the wild dog of India, called "buansuah" in the North and "dhole" in the South. Like the others it is normally rust-red in color, and makes its lair in rocky jungles. It is shy of mankind, and does not often attack cattle, but a pack will make even a tiger or a leopard turn tail.

None of these unwolflike animals called "dogs" belongs in the ancestry of our domestic races as is shown by the teeth. All kinds of our dogs have three molars on a side in each jaw, as in the genus *Canis,* whereas the dhole and other species of the genus *Cyon* have but two; and it is a rule in morphology that a character once lost may not be regained. Examination of the skull and other parts shows that all our domestic dogs must be derived from members of the genus *Canis.* Dogs have been found associated with natives of all parts of the world except the South Sea Islands, at their first discovery by Europeans, and sometimes in considerable variety. These, in all cases, were local wolves or jackals that had been tamed and more or less modified. The sledge-dogs of the Eskimos and Siberians were only subjugated wolves; those of our western Indians tamed coyotes; those of South Africa modified jackals; the "pariah" curs of the East came from the small red wolf of southeastern Asia; and so on, until intercommunication of tribes or of civilized with savage men, caused mixture of dog-races, and examples might be multiplied. In all these there is probably no admixture of fox blood, for the so-called "fox-dogs" of South America, which were captured and domesticated by the Indians there, are wolves, properly speaking. Foxes do not interbreed with wolves, jackals, or domestic dogs; whereas all these readily interbreed with each other, under captive conditions. Hence there has occurred from the beginning a mingling of various captive stocks, so that the domestic dog as we know him now is a composite that is quite inexplicable. One other element, however, entered into this calculation, and that is the probability that the modern dog may carry some inheritance from one or more extinct species to which it may owe its distinctively doggish aspect (short muzzle, etc.). We know that men of the Stone Age had dogs about their camps, notably among the Neolithic Swiss Lake dwellers. Rütimeyer, one of the best authorities, considers that their semifossil remains show such specific distinctions as to indicate derivation from neither wolf nor jackal, but from a distinct canine animal now extinct. This is by no means unlikely. Consult Mivart, 'Monograph of the Canidæ' (London 1870); Huxley, 'Cranial and Dental Characters of the Canidæ' (London 1880); Lydekker, 'Mostly Mammals' (New York 1903); Ingersoll, 'Life of Mammals' (New York 1907); and books on dogs and dog-culture.

DOG'S-TAIL GRASS, *Cynosurus cristatus,* a perennial grass, 1–2½ feet tall, with a very thin and fine stem and with a spike-like panicle made up of spikelets alternating on two opposite sides of the stem and of two different sorts, sterile and fertile. *Cynosurus* is an Old-World genus, and in England is one of the most important pasturage grasses. In America it is an escape from cultivation and grows in waste places, fields and waysides from Canada to New Jersey. It is much used for the manufacture of Leghorn hats on account of its great strength.

DOG'S TONGUE, a biennial plant, *Cynoglossum officinale,* belonging to the *Boraginaceæ,* borage family. It is a native of Europe, but has become naturalized in North America.

DOGTOOTH, *in architecture* an ornamented molding used in early mediæval times in the form of a four-leaved flower, with teeth projecting in the centre; also a steel punch used in working marble.

DOGWATCH, on shipboard, a name given to each of two watches of two hours each instead of four, adopted for the purpose of varying the hours of watches kept by each part of the crew during the 24 hours. The watches are arranged thus: 8 to 12 P.M.; 12 to 4 A.M.; 4 to 8 A.M.; 8 to 12 A.M.; 12 to 4 P.M.; 4 to 6 P.M., dogwatch; 6 to 8 P.M., dogwatch; 8 to 12 P.M., and so on.

DOGWOOD, the common name of the genus *Cornus,* a group of plants, either shrubs or trees, with entire leaves, and polygamous or dicecious flowers in cymes, but sometimes solitary. The fruit is a drupe. The genus consists of some 40 species natives of the northern temperate zone, Mexico, and parts of Peru. To this genus belong the American shrubs and trees, known as cornel (q.v.), dogwood, and kinnikinnik. The wood of *C. florida* is smooth, white and fine-grained, and is used for inlaying, and from the bark a febrifuge is made. Those who "dip" snuff, use the small branches of the tree to make the brush with which the snuff is applied. The common dogwood of Europe (*C.*

sanguinea) is a shrub of remarkable beauty in autumn owing to the deep redness of its foliage. The wood makes the very best charcoal for gunpowder. It is very hard, and is made into skewers, cogs for wheels, etc., and in former times it was in request for making arrows. The small bitter fruit yields as much as one-third of its weight of an oil resembling that of olive. The wood of *Rhammus frangula* is also used by gunpowder-makers, and called by them dogwood. Jamaica dogwood (*Ichthyomethia piscipula*) is a leguminous timber-tree; the cortex of the root is powerfully narcotic, used for stupefying fish or deadening the pain of toothache.

DOHERTY, Charles Joseph, Canadian jurist: b. Montreal, 11 May 1855. He was educated at Saint Mary's College and at McGill University, Montreal, was admitted to the bar in 1877 and was created Queen's Counsel by the Earl of Derby in 1887. From 1891 to 1906 he was puisne judge of the Superior Court of Quebec and in 1908 was elected to the House of Commons from Saint Anne's Division, Montreal. In 1911 he was made Canadian Minister of Justice and since 1909 has served also as professor of international and civil law at McGill University. He was one of the lawyers for the Society of Jesus in its libel suit against the Toronto *Mail*, and delivered judgment in the case of the Canada Revue Publishing Company vs. Archbishop Favre of Montreal in 1894.

DOHERTY, Henry Latham, American engineer: b. Columbus, Ohio, 15 May 1870. When 12 years old he entered the employ of the Columbus Gas Company, advanced rapidly and between 1890 and 1905 was engineer or manager of gas or electric companies in about 30 cities. In 1905 he organized the firm of Henry L. Doherty & Co. in New York as bankers, and operators of public utility corporations. He patented several pieces of apparatus used in gas manufacture, was awarded the first Beall gold medal in 1898 by the American Gas Light Association for his paper, "Gas for Fuel." He is a member of the American Academy of Political and Social Science and many other scientific bodies.

DOHM, dōm, **Ernst,** German humorist: b. Breslau, 1819; d. 1883. He studied theology and philosophy at Berlin and Halle and for many years was editor of *Kladderadatsch*, one of the most important humorous publications in Germany. He was ranked very high as a master of keen political satire. He translated Lafontaine's 'Fables' into German, with illustrations by Gustave Doré (1877) and published comedies, farces and poems, the most popular of which was 'Das erste Debüt' (3d ed., 1860).

DOHNANYI, dō-nŏn'yē, **Ernst von,** Hungarian composer: b. Presburg 1877. While a pupil at the Royal Conservatory at Budapest 1894–97 he took several prizes for composition. In 1897 he studied with D'Albert to perfect himself in the technique of the pianoforte previous to touring the chief cities of Austria, Germany and England. His tours of America in 1900 were successful. His pianoforte concerto in C minor took the Rosendorf prize, Vienna, March 1899. This he played with the Boston Symphony Orchestra. Other works are a concerto in Db, an overture, a Concert-stück for 'cello and orchestra, piano pieces, two symphonies and some chamber music and the comic opera 'Tante Simona,' produced in Berlin in 1913.

DOHRN, dōrn, **Anton,** German zoologist: b. Stettin, 29 Dec. 1849; d. 29 Sept. 1909. He studied at Königsberg, Bonn, Jena and Berlin, lectured for a time on zoology at Jena, and in 1870 he founded the great zoological station at Naples. As an embryologist he devoted himself mainly to the development of insects and crustaceans; and besides reports, he published works on the origin of the vertebrates including 'Der Ursprung der Wirbelthiere' (1875); 'Studien zur Urgeschichte des Wirbelthierkörpers' (1882).

DOIT, a small copper coin anciently current in Scotland, and equal in value to one-eighth of a penny sterling. There was also in Lower Germany a small coin called *deut*. In the Netherlands the coin is called *duyt*.

DOLABELLA, Publius Cornelius, Roman leader: b. about 70 B.C.; d. 43 B.C. He married Cicero's daughter Tullia, but treated her so harshly that she was ultimately obliged to leave him. He possessed considerable talents, but owing to his extravagance was compelled in 49 to seek a refuge from his creditors in the camp of Cæsar, and was present at the battle of Pharsalus (48). In the following year he obtained the tribuneship, and at once brought in a measure cancelling all debts, which led to an embittered struggle in Rome. He accompanied Cæsar to Africa and Spain, but on his leader's death, he usurped the consular insignia, allied himself with the conspirators, and made a show of republican sentiments. Appointed by Antony to the province of Syria, he murdered the proconsul, C. Trebonius, who had resisted his exactions, and at Laodicea, when about to fall into the hands of his enemies, was slain at his own request by one of his soldiers.

DOLABRA, dō-lā'bra, the Latin name for a Celt. See CELTS.

DOLBEAR, Amos Emerson, American educator and inventor: b. Norwich, Conn., 10 Nov. 1837; d. 23 Feb. 1910. He was graduated at Ohio Wesleyan University in 1866 and was professor of physics and astronomy in Tufts College 1874. He achieved eminence in scientific research, and among his numerous inventions were the writing telegraph (1864), the electric gyroscope (1867), the magnetic telephone (1876), the static telephone (1879), and the air space telegraph cable (1882). Among his discoveries were the convertibility of sound into electricity (1873), wireless telegraphy (1881) and electric photography (1893). He received several medals, including a bronze medal for an acoustic apparatus at the Centennial Exposition, Philadelphia, 1876, a silver medal in Paris 1881, and a gold medal in London 1882. Among his published works are: 'Chemical Tables'; 'The Art of Projecting'; 'The Speaking Telephone'; 'Matter, Ether and Motion'; 'Modes of Motion'; and 'Natural Philosophy.'

DOLCE, dōl'chā, or **DOLCEMENTE,** in music, an instruction to the performer that the music is to be executed softly and sweetly.

DOLCI, dōl'chē, **Carlo or Carlino,** Florentine painter: b. Florence, 25 May 1616; d.

there, 17 Jan. 1686. His works, which consist chiefly of madonnas and saints, exhibit the character attributed to him. The faces are full of a pleasing and tender softness, which, however, is often carried so far as to rob them of all character. Dolci's drawing is generally correct, his coloring exquisitely delicate and transparent, and in the nicety and laborious care of his finish he approaches the most characteristic examples of the Dutch school. His works are numerous and scattered over all Europe. Besides his madonnas his most famous works are his 'Saint Cecilia'; 'Christ Blessing the Bread and Wine'; and 'Herodias With the Head of John the Baptist.'

DOLCINITES (from Dolcino, their founder), a Christian sect which arose in Piedmont in 1304. See APOSTOLIC BRETHREN.

DOLDRUMS, a nautical term for the parts of the ocean near the equator that abound in calms, squalls and light baffling winds; otherwise known as the horse-latitudes; also applied to the weather variations characteristic of those regions. See CALMS, REGION OF.

DOLE, Charles Fletcher, American Unitarian clergyman: b. Brewer, Me., 17 May 1845. He is a brother of N. H. Dole (q.v.). He has been pastor of the Unitarian Church, Jamaica Plains, Boston, from 1876. He is the author of 'The Citizen and the Neighbor'; 'Jesus and the Men About Him' (1888); 'A Catechism of Liberal Faith' (1895); 'The American Citizen' (1891); 'The Coming People' (1897); 'Noble Womanhood' (1900); 'The Smoke and the Flame' (1903); 'The Spirit of Democracy' (1906); 'The Hope of Immortality' (1906); 'What We Know About Jesus' (1908); 'The Ethics of Progress' (1909); 'The Coming Religion' (1910); 'The Burden of Poverty' (1912).

DOLE, Nathan Haskell, American writer: b. Chelsea, Mass., 31 Aug. 1852. He was graduated from Harvard 1874, and after teaching at De Veaux College, Suspension Bridge, N. Y., and in the Worcester High School and serving as Preceptor of Derby Academy, Hingham, Mass., he was literary, art and musical editor of the Philadelphia *Press,* also musical editor of the *Bulletin* until 1887, when he became managing editor of the New York *Epoch.* That year he took the position of literary adviser to the publishing house of Thomas Y. Crowell & Co. In 1901, he was for a time head of the publicity department of D. Appleton & Co. His principal original works are 'Young Folks' History of Russia' (1881); 'A Score of Famous Composers' (1891); 'Not Angels Quite' (1893); 'On the Point' (1894); 'The Hawthorn Tree' (1895); 'The Mistakes We Make' (1898); and 'Omar, the Tent-Maker' (1898); 'Six Italian Essays' (1907); 'Alaska' (1909); 'The Life of Count Tolstoï' (1911), and 'The Spell of Switzerland' (1913). In 1904 he printed privately a 'Symphonic Poem' in four movements, entitled 'The Building of the Organ.' He followed this in 1911 with a second 'The Pilgrims,' also privately printed. This symphonic form gives to English poetry a medium only comparable to the Greek ode as invented by Pindar, since its possibilities of variety and scope are unlimited. In 1896, he furnished 250 poems for the 'Educational Music Readers' and in 1915 was chosen to write many of the songs for the Boston public schools. He was poet to the Ancient and Honorable Artillery Company of Boston on its 265th and again on its 270th anniversary. He also wrote the ode for the 100th anniversary of the Pierian Sodality of Harvard University and various other poems for public occasions. He translated in the course of 20 years Mascagni's 'Cavalleria Rusticana' and 'L'Amico Fritz' and other operas as well as hundreds of lyrics from Russian, Polish, Bohemian, the Scandinavian languages, also French, German, Dutch, Italian, Portuguese and other languages and dialects, mainly for music. In 1899 he edited the complete works of Count Tolstoï, whose novels, 'Anna Karénina,' 'War and Peace,' and many others he had already translated. He has also translated 'Marta y Maria,' 'Maximina,' and 'La Hermana Saint Sulpice,' from the Spanish of Valdes, as well as various works from the Russian, Italian, French, Swedish and German. In 1896 he edited a multivariorum edition of the 'Rubáiyât of Omar Khayyám,' containing versions in English, French, German, Italian, Hungarian and Danish carefully collated. He translated the 'Memoirs' of the Baroness Bertha von Suttner (1910) and her feminist novel 'Der Menschheit Hochgedanken' (1914). He was editor (with others) of 'The International Library of Famous Literature' (1898); 'Masterpieces of Famous Literature' (1899); 'Famous Orations' (1900); 'Library of Oratory' (1902); 'Flowers from Persian Poets' (1901); 'Young Folks Library' (1902); 'Vocations' (1910); also many editions of English, Latin, Greek and American poets. He was president of the Bibliophile Society (1901–12), for which he edited 'Marat's Letters' and other of its publications; president of the Omar Khayyám Club of America (1901——); also one of the trustees of the Fellowes Athenæum of Roxbury, Boston. His wife, HELEN BENNETT DOLE, translated Victor Hugo's 'Ninety-three,' Rudolf Baumbach's 'Sommermaerchen,' André Theuriet's 'L'Abbé Daniel' and 'La Vie Rustique en France,' Paul Marguerite's 'L'Avril,' Johanna Spyri's 'Heidi,' 'Moni' and 'Rosenresli,' Pierre Loti's 'Pêcheur d'Islande' and Klemens Brentano's 'Gockel, Hinkel und Gackeleia.'

DOLE, Sanford Ballard, Hawaiian statesman: b. Honolulu, Hawaii, 23 April 1844. He studied law in Boston and was admitted to the bar in 1868, returning in the same year to Hawaii. In 1884 he was made a member of the legislature and again in 1886. He had been, in 1887, appointed an associate judge of the Supreme Court, under the monarchy, which post he resigned to accept the leadership of the revolution that overturned the monarchy in January 1893, and established a provisional government. On 4 July 1894 a republic was formally proclaimed, of which he was elected president. Hawaii was created a territory in June 1900 and he was governor till 1903. In the latter year he was appointed judge of the Federal court for the Territory of Hawaii. This appointment was for six years, and upon its expiration he was reappointed to the same position, retiring to private life in 1915.

DÔLE, dōl, France, town in the department of Jura, 26 miles southeast of Dijon. It is situated on a hill round which the river Doubs

flows. The church of Nôtre Dame is of the 16th century, and is built in a Flamboyant style. The Hôtel Dieu is a fine Renaissance building. There is an art gallery, a college (once a Jesuit establishment) and a valuable library of 40,000 volumes. The manufactures are Prussian blue, hosiery, ironware, leather, vinegar, optical instruments, etc.; and the trade is chiefly in grain, flour, timber, wine, brandy, coal, iron, mill-stones and marble. It possesses many ruins of Roman architecture. From the hills above the town, Mont Blanc, 100 miles, may be seen. Dôle, at one time in the territory of the Dukes of Burgundy, was taken by Louis XI in 1479. It afterward belonged to Spain, but was finally brought under French rule in 1678. Pop. 16,294.

DOLERITE, the name given to a class of rocks, including dolerite proper, and the coarser-grained varieties of basalt, in which the minerals present can be detected by the naked eye. Dolerite itself consists of Labrador feldspar and augite, with some titaniferous magnetic iron ore, and other minerals. It has a dark-gray color, crystalline and small-grained, sometimes porphyroidal. Its specific gravity is 3. Its average composition is silica 50, alumina 15, oxide of iron 15, lime 10, magnesia 5, and the rest potash, soda and water. It is very widely distributed. With the introduction of the petrographical microscope and the resultant precision attained in rock investigation, the term is falling into desuetude.

DOLET, dō'lā, **Étienne,** French scholar and martyr: b. Orleans, France, 1509; d. Paris, 3 Aug. 1546. At the age of 12 Dolet went to the University of Paris, where his attention was directed to the study which became the chief interest of his life — the writings of Cicero. During a sojourn in Italy he imbibed an enthusiasm for the humanities, with its zeal for the classic writers and indifference to the teaching of the Church. In 1534 he settled at Lyons; in 1542 he obtained a license for 10 years to establish a printing press and published many notable works, but brought himself — not for the first time — under a suspicion of heresy, and in 1544 was found guilty of heresy on a charge mainly based on an alleged mistranslation of Plato, in which he was accused of denying the immortality of the soul. After two years' imprisonment, Dolet was burned in the Place Maubert, Paris, where a statue was erected in his memory in 1889 and round which a demonstration of anticlericals is annually held on the first Sunday of August. The proceedings in his trial were issued by Taillandier in 1836 from the registers of the Parlement of Paris. Consult Boulmier, 'Études sur le XVIième siècle; Étienne Dolet' (Paris 1875); Christie, 'Étienne Dolet, the Martyr of the Renaissance' (London 1899); Galbier, 'Étienne Dolet' (Paris 1907).

DOLGORUKY, dŏl-gŏ-roo'kē, **Katharina Michailow'na, Princess** Yurévskaya (b. 1846), the favorite of the Tsar, Alexander II, who married her in July 1880 after the death of his first wife, Marie. After the tsar's death she lived abroad and published in Geneva in 1882, under the pseudonym of VICTOR LAFERTÉ, 'Alexander II, Unedited Details of His Private Life and His Death.'

DOLICHOCEPHALIC (from Gr. δολιχὸς long, κεφαλή a head); longheaded: a term used in ethnology to denote those skulls in which the diameter from side to side is less in proportion to the longitudinal diameter (that is, from front to back) than 8 to 10. This form of skull is seen in an exaggerated form in native Australians and West Africans. The dolichocephalic skull of ordinary type appears among Indo-European races.

DOLICHOPODIDÆ, dol"ĭ-kō-pŏd'ĭ-dē, a numerous family of the order *Diptera,* some 1,200 species being known. They are small, metallic blue or green flies with slender legs and active habits. The larvæ live in the ground or in decomposing matter. They are not known to be harmful, but the flies are predaceous, and by this habit are beneficial to agriculture, catching, as they do, insects, and even worms, that are injurious to growing crops.

DOLICHOS (Gr. δολιχὸς long, that is, in pods), a genus of tropical herbs and shrubby plants of the family *Fabaceæ.* The 40 or 50 species, of which few are cultivated, are separated from species of the related genus *Phaseolus* by technical characters. The best known species are *D. lablab,* the hyacinth bean, a native of the tropics. It often twines around supports to a height of 20 feet, bears broad, often wrinkled leaves, purple, rather large flowers in erect, axillary racemes and flat, rather smooth pods containing several small, black seeds. It is an annual, frequently planted in sunny situations to form temporary screens and arbor covers. It succeeds well in any good garden soil, but attains the greatest growth and bears the most foliage upon rich soils. It has several horticultural varieties.

DOLL, a favorite plaything of children, found in variety of form and decoration. Most of the dolls found in the stores are made in the village of Sonneberg, in the Thuringian forest, Germany. Here the industry of making children's toys can be traced back to the 17th century, where the work of making them — as in other centres of the industry on the Continent — is divided among the various members of the household. Other villages in this vicinity and some towns in France and Switzerland also export large quantities of dolls to England and the United States. The importation of dolls into England was at one time almost entirely from the Netherlands, hence they were called "Flanders babies." There are about 40 doll manufacturers in London who make dolls of a superior kind. In France expensive life-size dolls are manufactured. There are a number of doll factories in the United States, where of late years "doll shows" or bazaars have been very popular. The phonograph doll, invented by Edison, created great interest when it was first introduced. The interruption of trade from Europe through the Great War has given an impetus to their manufacture in the United States: in New York one factory has been established with a productive capacity of 7,000 heads a day. The doll is the oldest toy known and is found among all nations and tribes, even of the most remote antiquity. Mr. Edward Lovett, of London, England, has made remarkable collections of those toys — one containing 2,000 specimens. The oldest in his collection is

one 4,000 years old, found in an Egyptian tomb, and another — a little broken image, with no arms or legs — is a relic of the Roman occupation of Britain.

DOLLAR (Low German *daler*, from *thaler*, short for *Joachimsthaler*, coined 1519 from silver mines in Joachimsthal, Bohemia, and standard for weight and purity), the unit of American currency. During the troubled periods in Europe previous to the 19th century some coins because of their intrinsic value, appearance and other qualities came to have a circulation far beyond the confines of the political state which placed them in circulation. Thus it came about that Prussia, Canada, Mexico and the United States received the name of their monetary unit from a section of the little country of Bohemia. Florence in the Middle Ages issued a coin which came to be known by the city's name, and the name is perpetuated in Holland, Austria and England. The West India trade before the Revolution had made the Spanish dollar — more convenient than the sovereign — the real unit of trade here; and the Coinage Act of 2 April 1792 merely legalized this fact, establishing the dollar as the unit of American currency, making it equivalent to 24.75 grains of fine gold and authorizing the coinage of silver dollars "of the value of a Spanish milled dollar the same as is now current" (see also CENT), and of halves and quarters correspondent. The first actual coinage was in 1794, dollars of 416 gr., 371.25 silver, .8924 fine. The dollar of account was rated at 4s. 6d. sterling, making the pound equal to $4.44; which, as the sovereign was 113 gr. gold, was too little and should have been $4.565. By act of 28 June 1834, the gold in the dollar was reduced to 23.20 gr., raised 18 Jan. 1837 to 23.22, where it remains, the pound having been unchanged, has since been equal to $4.86⅔. The last act made the weight of the silver dollar 412.5 gr., but raised it to .900 fine, the amount of silver remaining the same as before, 371.25 gr. On 3 March 1849, a coinage of gold dollars was authorized, weight 25.8 gr., .900 fine, 23.22 gr. pure gold; on 21 Feb. 1853, a $3 gold piece, same fineness, 77.4 gr.; and half and quarter dollars of silver, 192 and 96 gr. respectively, but legal tender only to $5. The act of 1873 discontinued the coinage of the silver dollar of 412.5 gr., but authorized one of 420 gr. (the "trade dollar") for the China and Japan trade. The fall in silver shortly after, however (at this time the silver dollar was worth rather more than the gold), inflated its value and made bullion owners anxious to have their metal coined into these, and on 22 July 1876, their coinage was limited to the actual demand for export, they not being intended for internal circulation — 35,959,360 were issued in all. The coinage was suspended April 1878. The act of 28 Feb. 1878 revived the coinage of the dollar of 412½ gr., and that of 14 July 1890 continued it. It is notable that many times more silver dollars have been coined since 1873 than before; up to 30 June 1872 the total number struck was only 8,045,838, while that of gold dollars was 19,015,642. The act of 14 March 1900 makes the gold dollar the standard of value in the United States. The law, however, did not provide for the issue of coins of this denomination.

DOLLAR BIRD, an Australian roller (*Eurostymus australis*), prevailingly blue and black in plumage, so called from the large roundish spot of white on its wing, shown in flight.

DOLLAR-FISH, a name used, particularly in Maine, for a small fish of the family *Stromateidæ*, more widely known as the butter fish or harvest fish (*Rhombus triacanthus*). It is found on the entire extent of the Atlantic coast of the United States and is extremely abundant during the summer on the shores of the New England and Middle States. The dollar-fish is from 8 to 10 inches long, of an oval form, with a blunt snout and small mouth; the color is silvery, bluish above, beautifully iridescent when alive. Great numbers are captured in seines and pound nets and they are highly valued as pan-fish. The young have an interesting habit of swimming, several together, in the company of large jellyfishes, beneath the disks of which they seek shelter and protection. Several allied species occur on both the east and west coasts of the United States.

DOLLARD, Adam, Sieur des Ormeaux: b. 1638; d. 1660. He was an officer of the French garrison at Montreal who, with 16 compatriots and a few friendly Indians, intercepted 500 Iroquois and held them at bay for five days at the Long Sault, on the Ottawa River above Montreal. He with all his companions perished; but the resistance they had met so disheartened the Iroquois that they abandoned their projected attempt on Montreal and the colony of New France.

DOLLART, The, an inlet (nearly landlocked) of the North Sea, at the mouth of the Ems, between the Dutch province of Groningen and the Prussian province of Hanover. It is nearly 13 miles long by seven broad. It was formed by inundations of the sea, which took place in 1277 and subsequently, overwhelming many large villages and hamlets, and destroying thousands of human beings, besides much valuable property. A considerable extent of rich land has been regained by embankment, especially on the Dutch shore. The city of Emden is in the Dollart.

DOLLIER DE CASSON, dŏl'yā dẹ̄ Cās-son, Sulpician: b. near Nantes, 1636; d. Montreal, 1701. He first served as a cavalry officer under Marshal Turenne. In 1657 he entered the Sulpician order, and went to Canada. In conjunction with Father Galinice he made in 1669–70 an important journey of exploration round the Great Lakes, spending the winter on the north shore of Lake Erie. In 1671 he was appointed superior of the Seminary of Montreal; in 1672 he laid out the first streets of that city; and he inaugurated the Lachine Canal undertaking. He wrote a history of Montreal covering the period from 1640–72.

DÖLLINGER, dĕl'ĭng-ẹr, **Johann Joseph Ignaz von,** German Roman Catholic theologian and historian: b. Bamberg, Bavaria, 28 Feb. 1799; d. Munich, 10 Jan. 1890. He received his preliminary education in his native city, and next entered the University of Würzburg, where his father was professor of anatomy and physiology. In 1817 he began the study of

mental philosophy and philology and in 1818 turned to the study of theology. He paid particular attention to the independent study of ecclesiastical history. He was ordained a priest in 1822 and in 1823 was appointed professor of ecclesiastical history and canon law at the Lyceum of Aschaffenburg. In 1826 he became professor of ecclesiastical history and law in the newly founded University of Munich, where he spent the rest of his life. Here he became famous as a historian, politician, and publicist. He published 'Die Lehre von der Eucharistie in den ersten drei Jahrhunderten' in 1826, and in 1828 a history of the Reformation. In 1835 appeared the 'Geschichte der Christlichen Kirche,' and in 1838 'Lehrbuch der Kirchengeschichte.' Döllinger contributed frequently to the *Historisch-politische Blätter* and published several pamphlets. His connection with politics began in 1845, when he represented his university in the Bavarian chamber; he lost his seat and professorship in 1847 on the fall of the Abel ministry, and in 1848 he was elected to the Frankfort parliament by a Bavarian constituency. Here he was recognized as the leader of the Roman Catholic party. He was recalled to Munich in 1849, and resumed his former place in the Bavarian chamber. In 1857 he visited Rome, and soon afterward it became evident that his views had undergone a change. Previously Döllinger had been an ardent defender of Catholicism and a bitter opponent of Protestantism; from now on he tended more and more to liberalism. Public announcement of this was made in a course of lectures which he delivered at Munich, in which he declared the temporal power of the Pope not an essential part of the Roman Catholic Church, and he expounded his position in 'Hippolytus und Kallistus oder die römische Kirche in der ersten Hälfte des dritten Jahrhunderts' (1853); 'Heidenthum und Judenthum, Vorhalle zur Geschichte des Christenthums' (1857); 'Christenthum und Kirche in der Zeit der Grundlegung' (1860), and 'Kirche und Kirchen, Papstthum und Kirchenstaat' (1861). This attitude of opposition became more pronounced in 1870, when he declined to accept the doctrine of papal infallibility formulated by the Vatican Council, and assumed the leadership of the Old Catholic party. As a result Döllinger was excommunicated by the Archbishop of Munich in 1871, but still retained the support of the Bavarian government. While the sentence was pending he was chosen rector of the University of Munich, and received numerous honorary degrees and decorations. He continued to lecture on ecclesiastical history and kindred subjects. Numerous works continued to come from his pen including 'Sammlung von Urkunden zur Geschichte des Konzils von Trient' (1876); 'Akademische Vorträge' (1891); 'Beiträge zur Sektengeschichte des Mittelalters' (1890); 'Briefe und Erklärungen über die vatikanischen Dekrete' (1890); 'Kleinere Schriften' (1890). In collaboration with Reusch he reprinted the autobiography of Bellarmine (1887), and 'Geschichte der Moralstreitigkeiten in der römisch katholischen Kirche seit dem XVI Jahrhundert' (1890). Several of his works have appeared in English including 'Declarations and Letters on the Vatican Decrees'; 'First Ages of Christianity'; 'Jew and Gentile in the Courts of the Temple of Christ'; 'Hippolytus and Callistus.' See OLD CATHOLICS. Consult the life by Friedrich (Munich 1901); also Kobell, 'Ignaz von Döllinger, Erinnerungen' (ib. 1891); and Michael, 'Ignaz von Döllinger, eine Charakteristik' (Innsbruck 1893).

DOLLIVER, Jonathan Prentiss, American lawyer and politician: b. near Kingwood, Preston County, W. Va., 6 Feb. 1858; d. Fort Dodge, Iowa, 15 Oct. 1910. He was graduated at West Virginia University 1875 and admitted to the bar 1878. He practised law in Iowa and was a member of Congress from that State from 1889–1900, and was a member of the Senate from 1900 until his death. He offered strenuous opposition to the Payne-Aldrich tariff.

DOLLOND, John, English optician of French descent: b. London, 10 June 1706; d. there, 30 Nov. 1761. He devoted his attention to the improvement of refracting telescopes, and succeeded in constructing object-glasses in which the dispersion of the rays of light was corrected. Subsequent members of his family have distinguished themselves in optics, astronomy, etc.

DOLL'S HOUSE, A. The theme out of which 'A Doll's House' was constructed was not of sudden choice. In his notes for this modern tragedy, Ibsen jotted down, under date of 19 Oct. 1878, the following statement:

> "A woman cannot be herself in the society of the present day which is an exclusively masculine society with laws framed by men and with the judicial system that judges feminine conduct from a masculine point of view."

Those who take 'A Doll's House' as indication that Ibsen was a champion of the woman question are wrong in their conclusions; for he was interested much more in the larger spiritual question of the equality of the sexes. If he stressed the feminine in his plays, to the detriment of the masculine, it was simply because he felt that the weaker side of the argument needed the stronger support, in order to reach an equal balance of fairness and justice. 'A Doll's House' was completed while Ibsen was spending the summer of 1879 in Amalfi; and it was almost immediately published. It raised a storm of protest everywhere, and for many years was regarded solely as an attack upon marriage. Ibsen was called every preposterous name imaginable. The only way in which the play was allowed to be given in London was in an adapted form made by Henry Arthur Jones and called 'Breaking a Butterfly'; it was produced at the Princess Theatre, 3 March, 1884.

Nora's slamming of the door in her husband's face, as she leaves the house, resounded throughout the world. Debates were held everywhere as to whether Nora was justified in leaving her home, whether it was the true act of a mother and a wife, and whether Nora, in the end, would return to Torvald, her husband.

As an acting drama, 'A Doll's House' has held the stage and has been as much a goal for the young actress as 'Camille.' Apart from its philosophic preachment, it is a portrait of a most interesting woman,— not as subtle a portrait as Hedda Gabler, or as Rebecca West in 'Rosmersholm,' but affording, in deep psychology, as well as in such outward scenes as the Christmas Tree, the Tarantella dance, and the denunciation scene, ample opportunity for histrionic ability. Eleanor Duse, Madame Réjane,

Agnes Sorma, Mrs. Fiske, Madame Nazimova and Ethel Barrymore, are among the many who have attempted the rôle. The play was first seen in America when, during 1883, in Louisville, Ky., Madame Modjeska acted Nora. It was first played in London, in its regular form, by Janet Achurch and Charles Carrington, at the Novelty Theatre, 7 June 1889.

MONTROSE J. MOSES.

DOLLY VARDEN, the soft-hearted, wily little coquette in Dickens' novel 'Barnaby Rudge.' The impression made by the author's description of her dress of flower-sprinkled dimity led to the adoption of a style of dress that is known as the Dolly Varden and was the vogue from about 1865–70. The name is often applied to any light dress-goods with bright-colored flower effects.

DOLLY VARDEN TROUT, the common brook trout (*Salvelinus malma*), a char of the mountains of western North America, and northward in the coastal streams to the Aleutian Islands, so called because of the beauty of its markings, which are said to resemble the coloring of a Dolly Varden (q.v.) dress. The trout is voracious and game, often attains a weight of 12 pounds. Its general color is olivaceous, the sides with round, red or orange spots as large as the eye. In the region of its native waters it is known as the bull-trout, red-spotted trout and salmon trout. It was at one time regarded as identical to the malma of Kamchatka, but recent investigation has shown them to be different species. It has been used to stock streams in the northeastern States, Canada, and Europe.

DOLMAN. (1) A long robe worn by the Turks as an upper garment. It is open in front, and has narrow sleeves buttoned at the wrist. (2) It has given its name to a kind of loose jacket worn by women as an outer garment. It has a cape or hanging piece over the arm instead of a sleeve. (3) The uniform jacket of a hussar.

DOLMEN, a structure consisting of one or more large unhewn stones, resting on a number of unhewn stones, placed erect in the earth. The name is sometimes used as equivalent to cromlech, sometimes in a distinctive sense. Sir John Lubbock maintains that cromlech should be applied to a stone circle, dolmen to a stone chamber, such circle or chamber consisting of huge stones set up in prehistoric times for religious or sepulchral purposes or as memorials of some important event. They are of very wide distribution; there are over 3,400 in France, mainly in Brittany, and are to be seen in the British Isles (especially Ireland). Scandinavia, Holland, Germany, the Crimea, Persia, Arabia, Palestine, Madagascar, Australia and Japan are among the countries in which they have been discovered. Consult Barlase, 'The Dolmens of Ireland' (London 1897); Keane, 'Ethnology' (Cambridge 1896).

DOLNJA TUZLA, dōl'nyä tooz'lä, Bosnia, Austria-Hungary, town beautifully situated on the Julla about 20 miles from the Servian frontier. It is celebrated for its salt mines, has a trade in alkali and coal, and was the scene of an Austrian defeat of the Turks in 1690. Pop. 12,000.

DOLOMIEU, do-lo-mē-ė, **Déodat Guy Silvain Tancrède Gratet de,** French geologist and mineralogist: b. Dolomieu (Isère) 24 June 1750; d. Chateauneuf, France, 26 Nov. 1801. In youth he became a member of the Knights of Malta, and having killed a brother knight in a duel, was condemned to death but pardoned on account of his youth. He was appointed correspondent of the Academy of Sciences of Paris, and from 1777 to 1791 made extensive travels in the south of Europe, often on foot, with a hammer in his hand and a bag on his back. In 1796 he was appointed professor or lecturer in the School of Mines, and on the establishment of the institute was made a member of that society. In 1798 he accompanied Napoleon to Egypt, and on his return was detained at Messina by the Neapolitan government for having revealed in 1783 its plans for the conquest of Malta to the grand master of the knights. He was imprisoned for 21 months in a noisome dungeon, clothed in rags, with nothing but straw for a bed. Deprived of writing materials, he made a piece of wood into a pen, and with the smoke of his lamp, for ink, he wrote on the margins of his Bible, his 'Philosophie Mineralogique' (published 1801). In 1801 he received the professorship of mineralogy in the museum of natural history. The mineral "dolomite" which he was the first to describe, is named in his honor. Among the works left by him are 'Voyages aux les de Lipari' (1783); 'Sur le Tremblement de Terre de la Calabre' (1784).

DOLOMITE, carbonate of calcium and magnesium [$(Ca,Mg)CO_3$], containing normally 30.4 parts lime and 21.7 parts magnesia, but varying in the ratio of the two carbonates. Iron and manganese carbonates are sometimes present as impurities. The crystallization is rhombohedral; the hardness 3.5 to 4; specific gravity 2.8. The color is normally white but may be reddish, grayish, brownish, or even black. In general the mineral resembles calcite but differs in not effervescing freely with cold acid, even if finely powdered. Massive dolomite in the form of dolomitic limestone is a rock of common occurrence and sometimes forms strata of great extent and thickness. Such limestones frequently show all transitions from nearly pure calcite to true dolomite. Generally, a limestone containing over 5 per cent MgO is described as a magnesian limestone. Under pressure dolmitic limestones and dolomites become crystalline and are classified as marbles. Many of the great limestone formations in the United States are more or less dolomitic. See DOLOMITIZATION; LIMESTONE; ROCKS.

DOLOMITE MOUNTAINS, or **DOLOMITE ALPS,** a group of mountains, part in Tyrol and part in Italy. The name comes from the rock dolomite of which the mountains are largely composed.

DOLOMITIZATION, the process by which the calcium in limestones is replaced by magnesium, forming dolomitic limestones and dolomites. The exact nature of this process is still a matter of doubt. Dolomites cannot be formed directly from the calcareous remains of animals, since they contain a much larger proportion of magnesia than any animal shells or tests, and the magnesium therefore was probably added after the calcareous material had accumu-

lated. In the lagoons of coral reefs, the enclosed body of sea water becomes concentrated by evaporation, and the chloride of magnesium (present in all sea water) by a process of double decomposition forms magnesium carbonate from the calcium carbonate of the coral rocks. It is also possible that fine calcareous mud in suspension in sea water may exchange some of its calcium directly for magnesium. See DOLOMITE.

DOLORES, dō-lō'rĕs, **El Grito de,** literally, "The cry, or outcry, of Dolores," marking the commencement of the Mexican War for independence. On the night of 16 Sept. 1810, Don Miguel Hidalgo y Costilla, the parish priest of the town of Dolores (q.v.), gathered a number of patriots under his banner to the cry of: "Long live religion! Long live our Most Holy Mother of Guadalupe! Long live America, and death to bad government!" All previous attempts (1798–1810) to rebel against the Spanish authorities had been suppressed; but Hidalgo and his enthusiastic followers were victorious in several engagements. Although he and his lieutenants, Allende, Aldama and Jimenez, were captured and put to death in 1811, the movement they began was carried on until the revolutionists triumphed, 27 Sept. 1821, Yturbide entering the capital on that day. See MEXICO.

DOLORES HIDALGO, ē-dāl'gō, Mexico, a town in the state of Guanajuato, department of Allende, about 41 miles from the capital of the state, which is also called Guanajuato. Pop. 6,764.

DOLPH, John Henry, American painter: b. Fort Ann, N. Y., 18 April 1835; d. New York, 28 Sept. 1903. He studied at Antwerp and in Paris, then opened a studio in New York; he was a member of the National Academy and was one of the founders of the American Society of Artists. His works include 'Knickerbocker Farm Yard'; 'Season of Plenty'; 'Horse Doctor'; 'A June Day'; 'Who Will Bell the Cat'; 'Cat and Kittens'; 'A Princess'; 'Fish Commissioners'; 'Alexander and Diogenes'; 'The Waste Basket'; 'A Society Lion'; and 'Called to Order.' His pictures of animals, and particularly cats, are best known.

DOLPH, Joseph Norton, American statesman: b. Dolphsburg, N. Y., 19 Oct. 1835; d. Portland, Ore., 10 March 1897. He studied law, and began practice at Binghamton, N. Y. In 1862 he settled in Portland, Ore., taking up the practice of law there. In 1864 he was elected city attorney, and was appointed United States district attorney. He was a member of the State senate four consecutive terms, sat in the United States Senate from 1883–95. In his second term he was chairman of the Committee on Coast Defenses, a member of the Committee on Commerce and an active opponent of the free coinage of silver.

DOLPHIN, a group of cetaceans belonging to the family *Delphinidæ*. The common species (*Delphinus delphis*) is found chiefly in the Mediterranean and North Atlantic Ocean. It is from six to eight feet long; the body tapers toward the crescent-shaped tail, which is about a foot broad. The blow-hole is also crescent-shaped; and the beak is usually about six inches long. The dolphin is blackish on the back, and white below, the sides being gray. The female produces but one at a time, and devotes herself assiduously to caring for it. There are numerous species of dolphin, each confined, apparently, to a comparatively narrow range. All are voracious, and feed on other fish and crustaceans, and are said to eat even the disabled and feeble of their own kind. They live in herds or "schools," and may be seen by ocean voyagers playing about the vessels. They will leap in graceful curves, into the air, make sudden descents into and through the waves, followed by a track of foam. Then they will reappear, show their slender back-fins, expose their broad tails as they plunge below the water; and almost before one has missed them, they will rise on the other side of the ship. They are a source of pleasure to the ocean traveler; and furnish more substantial gratification to the sailors, who eat their flesh with much relish after their usual rations of salt-pork. The grampus, the porpoise and many of the so-called whales, such as the white-whale, the killer-whale and others, are related genera; as are also the soosoo of the Ganges, and the bouto of the Amazon, which inhabit fresh water instead of the ocean. The dolphin gave the name to Dauphiné, one of the provinces of France, from which the "dauphin," the heir-apparent to the French throne, derived his title. Consult Beddard, 'A Book of Whales' (1900).

DOLPHIN IN ART. This sea mammal has been adopted by both pagans and Christians as a symbol of the dead. It has been used in Christian art also as emblematic of swiftness, diligence and love. In classic Greek art we find the dolphin figuring on buildings, on pottery, coins and mural paintings. It was used as symbolizing the sea or water, in the same manner as they used a flower to represent land. The dolphin figured as an attribute accompanying nymphs, nereids, tritons, also Arion, Aphrodite, Poseidon, Apollo, Neptune, etc. As symbol of the sea it, naturally, often appears in company with an anchor or a trident. A dolphin entwining an anchor was the device or badge of Aldus Manutius (1447–1515), the Venetian printer — Venice being "mistress of the Adriatic." The dolphin figures in French art for the following historic reason. In 1140, Guigo IV, of Viennois, adopted the title of "dauphin" and took as his crest a dolphin. Humbert II, a successor, exchanged the *dauphiny*, in 1349, for a legacy, Charles of Vallois receiving the title conditionally that the title "Dauphin" should be attached always to the heir to the throne. In ceramics the dolphin (crowned) figures as the mark of Lille porcelain (18th century). At the present day the dolphin is greatly favored as a decorative device on fountains, etc.

DOMAIN, from the Latin *dominium*, right of absolute ownership, property, dominion. The territory over which Dominion is exercised; the territory ruled over by a sovereign, or under the government of a commonwealth, as the domains of Great Britain. The term public domain is used in Europe, as property belonging directly to and controlled by the state, such as lands set apart for state or public uses, roads, canals, parks, etc. In the United States the lands owned by the Federal government or by a State.

DOMANIG, dō-mān'ih, **Karl,** Austrian numismatist: b. Sterzing, Tyrol, 3 April 1851. He was educated in the high schools of Innsbruck and Strassburg and at the Gregorian University, Rome. In 1880 he was appointed tutor to the children of Duke Philip of Württemberg and until 1891 served in the same capacity to several of the archducal members of the Imperial family of Austria. From 1884 to 1913 he was also engaged successively as assistant custodian, custodian, director and counselor of the Imperial Coin and Medal Collection, Vienna. He traveled extensively for the purpose of artistic research and is honorary member of many Austrian and foreign numismatic societies. In commemoration of his valuable services as its first director the administration of the Vienna Imperial Medal and Coin Collection issued a medal bearing Domanig's head; the town of Sterzing placed a memorial tablet, cut from native marble, on the house of his birth. He has published 'Eine katholische Burschenschaft' (2d ed., 1873); 'Der Tyroler Freiheitskampf' (3d ed., 1909); 'Der Gutsverkauf,' a drama (1890); 'Die deutsche Privatmedaille der ältern Zeit' (1893); 'Porträtmedaillen des Erzhauses Österreich' (1896); 'Die Fremden,' a novel (1898; 3d ed., 1911); 'Die deutsche Medaille in kunst- und kulturhist. Hinsicht' (1907); 'Die Entstehung von Wolframs Titurel' (1911); 'König Lauren,' drama (1912). He edited the *Tyroler Kalender* for three years, and *Klassische Andachtsbilder,* and contributed to *Gral,* 'The Catholic Encyclopedia,' and several anthologies.

DOMAT, dō-mä', **Jean,** or **DAUMAT,** a French jurist: b. 1625; d. 1696. He is noted for his 'Lois civiles dans leur Ordre naturel' (3 vols., 1689–94), which Blackstone considered a monumental work. Domat also wrote 'Le Droit public' (published 1697) and 'Legum Delectus' (1700). Pascal, with whom he was on terms of very intimate friendship, bequeathed to him his private papers.

DOMBEY AND SON, a novel by Charles Dickens, published in 1848. It represents a man of proud and unbending nature who centres his worldly ambitions in an only son, but who becomes broken and subdued by his child's death, family disgrace and financial ruin. Paul Dombey, Jr., is a puny child whose only companion is his sister, Florence, somewhat his senior. The two children are orphans, their mother having died on giving birth to Paul. The father, Paul Dombey, Sr., neglects the girl, and finally becomes jealous of her influence over her brother. So the boy is sent to school at the age of six with Doctor Blimber, where he sickens and dies under the strain of forced work and grief at separation from his sister. Dombey marries again, and ill-treats and neglects his wife, a proud sensitive woman, who has discovered the good qualities of the little Florence. Finally she is goaded to elope with Dombey's manager Carker. In a passion Dombey strikes his daughter and orders her to follow his wife with whom she has, he asserts, always been in league. Florence leaves home and goes to the house of Solomon Gills, where she meets her lover, Walter Gay, Gills' nephew, who has just returned from a long sea voyage. They are married, and embark on a wedding trip. In the meantime Dombey speculates recklessly and is ruined. Florence goes to him in his trouble and offers him a home, which he accepts. And there he lives his life out devoted to his two little grandchildren.

DOMBOC, dōm'bōk, or **DOOM-BOOK** (A. S. "book of dooms or sentences"), the code of laws compiled by King Alfred, who made few if any original laws, but contented himself with restoring, renovating and improving those which he found already in existence. Alfred's religious character is strongly impressed on his code, which begins with extracts from the Bible. Then follow the Ten Commandments, the part of the Mosaic law relating to criminal offenses, and passages from the New Testament, including the Golden Rule. The code was ratified by the Witan, as Alfred expressly informs us. Thorpe gives it in his "Diplomatarium Anglicanum ævi Saxonici' ('English Diplomatarium of the Saxon Era') (1865). Consult Pauli, 'Alfred the Great,' from the German (London 1857).

DOMBROWSKI, dōm-brôf'skē, **Jan Henryk,** Polish general: b. Pierszowice near Cracow, 29 Aug. 1755; d. Wina-Gora, Prussia, 6 June 1818. After serving under the Elector of Saxony he returned to take part in the Polish campaigns against Russia and Prussia in 1792–94. Next entering the French service, he organized a Polish legion at Milan; and in the campaigns which followed, Dombrowski and his Poles took a distinguished part. After the fall of Napoleon he returned to Poland and was appointed by the Emperor Alexander a general of cavalry and Polish senator.

DOME. See CUPOLA; FOLDS.

DOME OF THE ROCK, a name given to the Mosque of Omar, Jerusalem. It stands on Mount Moriah, on the site once occupied by the Temple of Solomon. Immediately under its dome is an irregular-shaped rock. This rock was the scene of many scriptural events, and has been greatly revered for ages. See JERUSALEM.

DOMENICHINO, dō"mā-nē-kē'nō, or **DOMENICO ZAMPIERI,** Italian painter: b. Bologna, 28 Oct. 1581; d. Naples, 15 April 1641. He was sent to study first with Calvart, and afterward with the Caracci. From the slowness of his execution he was named, by his fellow-students, the "ox of painting"; but Annibal Caracci predicted that the ox would "plough a fruitful field." Having contracted a great friendship for Albano he joined him at Rome, and his former master, Annibal Caracci, jealous of Guido, procured for him the execution of one of the pictures for a church which had been promised to that great painter. It was a custom with Domenichino to assume, for the time, the passion he was depicting; so that, while working by himself, he was often heard to laugh, weep and talk aloud, in a manner that would have induced a stranger to suppose him a lunatic. The consequence, however, was, that few painters have surpassed him in lively representation. His 'Communion of Saint Jerome,' now in the Vatican collection, has been considered, by some connoisseurs, inferior only to the 'Transfiguration' of Raphael; and the 'History of Apollo,' which he painted in 10 frescoes for Cardinal Aldobrandini, is a notable series. His merit excited so much envy that he

retired to his native city and employed himself two years on his famous picture of the 'Rosary' now in the gallery of Bologna. He was afterward recalled to Rome (1621) by Gregory XV, who created him his first painter and architect of the Vatican. Losing this post after the Pope's death, he accepted an invitation to Naples, to paint the chapel of Saint Januarius. But here he encountered a jealousy so rancorous that his life became altogether embittered by it; and so great was his dread of poison, that he prepared all his eatables with his own hand. Domenichino, who understood every branch of his art, produced nothing excellent without study and labor; but in consequence of his great premeditation, no painter has given his pieces more of the properties belonging to the subject. At the same time his designs are correct; and he succeeded equally in the grand and the tender. Nearly 50 of his pieces have been engraved. Consult monographs by Breton (1867); C. Landon (1823); Roncagli (1842), and Serra (1909).

DOMESTIC INTERIOR DECORATION. See INTERIOR DECORATION.

DOMESTIC RELATIONS, *in law,* the legal relations existing between the members of a family or domestic group. In its widest application the term includes parent and child, husband and wife, guardian and ward, master and servant. Other classifications omit master and servant or restrict the latter term to domestic servants. The law of domestic relations embraces all those rules appertaining to the particular classes of persons above mentioned, and is a term of convenience rather than logical classification. Generally speaking, it may be said to be made up largely of the law of contract, tort and agency. It treats the subjects of marriage and divorce, the rights and liabilities of parents and children, the rights and liabilities of guardians and wards, and various allied topics. In late years much legislation has been passed on this subject in the various States, particularly so in New York, which has codified it in a statute known as the Domestic Relations Law. See DIVORCE; FAMILY, LAW OF; HUSBAND AND WIFE.

DOMESTIC SCIENCE. See HOME ECONOMICS.

DOMESTICATED ANIMALS. See ANIMALS, DOMESTICATED.

DOMETT, Alfred, English poet: b. Camberwell Grove, Surrey, England, 20 May 1811; d. London, 2 Nov. 1887. He was the original of Browning's 'Waring.' He lived in New Zealand, 1842–71, and became a colonial statesman of eminence. His verse attracted much attention, the best specimens being in the volumes 'Ranolf and Amolia' (1872); and 'Flotsam and Jetsam: Rhymes Old and New' (1877). Consult Gisborne, 'New Zealand Rulers and Statesmen' (1897).

DOMICILE is the permanent, fixed home of a person, with no present intention of removing therefrom. A person traveling from one city, State, or country into another does not change his domicile and create a new one at every place he stops, but the place to which he intends to return and reside permanently is his domicile. Generally speaking, a person can have but one domicile at one time; but for different purposes, he may have more than one domicile at one time. Some things for which it is necessary to have a domicile are: administration of a person's estate, jurisdiction, taxation and homestead exemptions. Some countries of Continental Europe ignore domicile altogether, basing their rules of law as to personal status upon nationality alone. In America, the place at which a person exercises his political rights and privileges, and which he calls his home, is considered his domicile. The two things necessary to a domicile are an actual residence and a present intention of remaining there.

The place of birth is a person's original domicile, unless his parents were on a journey at the time, in which case their home is the domicile of birth. This domicile may be abandoned for another, of one's own choice. When the domicile of choice is abandoned the domicile of origin revives until a fresh domicile is again selected. After a person has once acquired an actual domicile, he does not lose it by a temporary absence, no matter how long it is continued, if he intends to return; and in cases where a person changes his domicile he does not lose the old place of domicile, until he has actually acquired the new one. While the intention of the person enters into the question of domicile, it is not a controlling feature; and in a change of domicile the intention must be reinforced by some act, such as exercising a political right, engaging in business, paying taxes, and executing a will, according to the laws of the place; all of which are evidence of the intention to create a new domicile. When persons are married, the wife acquires the domicile of her husband; and all children born acquire the domicile their father had at the time of their birth. If a widow with minor children marries, the domicile of the children is not changed until there is an actual removal. Illegitimate and posthumous children acquire the domicile of their mother in most jurisdictions.

A person absent from home on the service of his government, such as an ambassador, consul, soldier or sailor, does not change his domicile; unless, after the service is finished, he continues to reside at that place. A convict or prisoner, a person attending a college or university, does not change his domicile. In case of war it is held that the property of an alien domiciled in a country at war with his own is liable to confiscation as that of an alien enemy. A person may acquire a commercial domicile in a place different from that in which he lives. When a person goes to a foreign country and engages in business there, he is considered a merchant of that country; and it makes no difference what the relations of the government of the countries are with one another.

The domicile of a sailor is where he voluntarily spends most of his time when on shore. A man may become a subject of a new country without losing his domicile in the old.

A guardian cannot change his ward's domicile from one country or State to another; and it is doubtful even if he can change the domicile from one county to another in the same State. The nature and purpose of the appointment of a guardian may, however, change the general rule. The appointment of a guardian will not prevent the ward from changing his domicile. The question of domicile is important in the case of

marriage contracts. Whether or not two persons have the capacity to marry depends on the rules of the law of their domicile; but whether the marriage has been validly contracted, on the rules of the law of the place where the ceremony was performed; but generally speaking, a marriage validly entered into according to the laws of the place where it is contracted is valid anywhere. Although the domicile of the wife is considered as that of the husband, yet in actions for divorce, a husband, after giving his wife a cause for divorce, cannot acquire another domicile so as to deprive her of that right. In wills, the law of the domicile of the testator governs as to the validity of the execution and the distribution of personal property; but as to real estate, if it is to pass under the will, the testator must execute the will according to the laws of the place where the property is situated. Corporations are considered as domiciled in the country or State from which they have derived their charters. Consult Bentwich, 'Law of Domicile in its Relation to Succession' (London 1911); Dicey, 'Law of Domicile' (ib. 1879); and 'Conflict of Laws' (ib. 1896); Jacobs, 'Treatise on the Law of Domicile' (Boston 1912).

DOMINANT, in music, is the fifth note above the tonic or keynote of any scale. It is always major in both major and minor modes, as its harmonies rule or determine the scale. Originally so called because in the ecclesiastical system it was the principal reciting note of the Gregorian chant. It also marks the division of the scale into two co-ordinate parts, as in a fugue when the subject commences with the tonic the answer starts with the dominant, or the reverse. In the sonata form it used to be an almost invariable rule to start the second subject in the dominant key.

The *dominant chord* is the major triad on the fifth of the major or minor key. Thus of *C* the triad would be *g-b-d*. A *dominant seventh* is formed by adding a minor seventh to the triad. Add *f* to the dominant triad given above and you have the dominant seventh of *C*.

DOMINE, do'mĭn-ē, the title of a minister of the Reformed churches of the Netherlands, South Africa and America, unaltered from the Latin vocative of dominus, master or lord. It is so written in all the old Dutch and American colonial documents, the form of address being often abbreviated to «Dom. auct» (oritate), pastor with authority. As many Dutch teachers went to Scotland and thousands of Scottish students and ministers for study in Holland, the term was borrowed and became popular in Scotland, but their dominie is spelled as in the character «Dominie Sampson.» The title domine is used as a common noun, as well as an affectionate form of address in the Middle States and in the West. There are several American books with titles showing misspelling of this term, but the true orthography should be Domine to be correct — Murdock, 'The Dutch Dominie of the Catskill,' 'The Dominie's Daughter,' and 'The Dominie of Haarlem.'

DOMINGO, San. See SAN DOMINGO.

DOMINIC, Saint, founder of the order of Dominicans or Preaching Friars: b. Calaroga, in Old Castile, Spain 1170; d. Bologna, Italy, 6 Aug. 1221. According to the legendary story of his life his future eminence in the church was foreshown to his mother before his birth by preternatural premonition, for she dreamed that she saw a dog presenting to her child a flaming torch with which to set the world ablaze. This explains the meaning of the dog with torch in his mouth, seen in many pictures of Saint Dominic. In childhood he gave signs of extraordinary piety and love of ascetic practices. At 17 he entered the University of Palencia (removed later to Salamanca), and devoted himself to the study of philosophy and ancient literature. Here on one occasion he sold his clothes in time of famine to obtain the means of relief for the poor; on another occasion he offered himself to be a slave to the Moors in exchange for a widow's only son. He stayed in the university 10 years, and, having been ordained priest, was made a member of the cathedral chapter of Osma, and in that station was the zealous assistant of the bishop in suppressing abuses in the Church. He accompanied this bishop on an embassage to France in 1203, and in passing through Provence was grieved by the extreme laxity of morals in clergy and laity and the alarming progress of the various Manichæan sects. Dominic vowed himself to a life of evangelical labor among those sectaries, and resolved to make all possible efforts for the correction of the evils which menaced the existence of the Church in those parts. There were already in the field legates commissioned by the Pope to win the erring back to the fold; but Dominic was scandalized by their worldly pomp, and declared that not in costly attire and with a showy retinue should they approach the misguided Albigensians and the poor men of Lyons, but barefoot and without purse or scrip; and the papal envoys, persuaded by the words of the zealous evangelist, laid aside their state and for a while followed the examples of humility and zeal set by Dominic. But their preaching proving unfruitful, they retired from the field and reported to Rome their failure. Nor was Dominic himself rewarded with much success in his 10 years' labors, though the annals of his life tell of great miracles which attended his progress through the country. Then resort was had to force, and a crusade against the Albigensian heretics was proclaimed; which was conducted by Simon de Montfort with extreme severity till, at his death in the siege of Toulouse, resistance on the part of the Albigenses was overcome. No proof exists that Dominic either prompted the crusade or had any part in it; but it is certain that he was a friend of Simon de Montfort and of his family. He quit the country in 1217, one year before the end of the war, and withdrew to Rome, where he spent the remainder of his life in organizing the order of Preaching Friars. He arranged the prayers and meditations of the devotion called the 'Rosary,' much in use by Roman Catholics in all parts of the world. He was canonized in 1234. See DOMINICANS; ROSARY. Consult Drane, 'Life of Saint Dominic' (3d ed., London 1891); Guiraud, 'Saint Dominic' Paris 1901; Eng. trans., New York 1901); Herkless, 'Francis and Dominic' (New York 1901); Jordanus de Saxonia (the principal source), 'Opera ad res Ordinis Prædicatorum Spectantia' (Fribourg 1891); Lacordaire, 'Vie de Saint Dominique' (Eng. trans., London 1883).

DOMINICA, dŏm-ĭn-ē'kȧ, or **DOMINIQUE,** dōm-ē-nēk', West Indies, an island in the northern half of the Caribbean chain of the Lesser Antilles. (See ANTILLES). It is the largest of the British Carribbees, being 29 miles long, 16 miles broad, and having an area of 291 square miles; it has also the highest summit of this volcanic island chain, the Morne Diablotin (5,314 feet), several thermal springs, and an old crater-lake about 2,800 feet above sea-level which formerly "was flooded by boiling water from springs bubbling up from the bottom, and every five minutes upheaving in a foaming geyser." The area of this lake was diminished by landslides which occurred in 1880, but it is still of great depth. The rainfall of the island is very abundant. The summer temperature is about 80° F.; that of winter, spring, and autumn about 70° F. An interesting part of the population is a group of Caribs (q.v.), about 400, though these aborigines are now largely mixed with the blacks. There are about 100 apparently pure Caribs. "They inhabit the mountains of the interior, and make their livelihood by weaving a peculiar basket which is universally used in the island for carrying baggage." The blacks referred to, descendants of African slaves of the period when Dominica belonged to France, are by far the most numerous element; they, as well as most of the white inhabitants, speak a French patois, and "still look upon the British owners as foreigners." With the exception of the Indians, the people live near the coasts. In the luxuriance and beauty of its vegetation, Dominica excels the other neighboring islands. Its soil is a rich brown mold, in which all tropical products grow readily. Of its 186,240 acres, two-thirds are crown lands, but the government has utterly failed to promote agriculture, which is now nearly ruined. Exports are cattle, cocoa, lime-juice, rum, molasses, coffee, fruit and sugar. The revenues do not equal expenditures, and taxes are increasing. In 1915–16 the revenues amounted to $253,180, and the expenditures to $284,975. Imports in 1915–16 were valued at $956,325 and the exports at $1,092,330. There are 432 miles of telephone line in operation. Dominica is a presidency, belonging to the British Leeward Island administrative group, which includes also Saint Christopher, Nevis, Antigua, Barbuda, Montserrat, Redonda, and the British Virgin islands, the seat of the Leeward government being at Saint John, Antigua. The local government is conducted by a commissioner, or president, an executive council of seven members, and a legislative council of 12 nominated members. These officials exercise their authority at the small town of Roseau, which is situated on the western side of the island, and has wide and regularly paved, but deserted, streets, a botanical garden, a public library, and French (Catholic) and English churches. The name of the island (from Spanish *Domingo,* Sunday) is due to the circumstance that Columbus discovered it on the first day of the week, 3 Nov. 1493. The warlike Caribs retained control of it during two centuries, but little by little French settlers gained a foothold, and in the 18th century its possession was regarded as essential to the maintenance of French prestige in the West Indies, owing to its situation between the important dependencies of that country, Martinique and Guadeloupe. For that very reason the English insisted upon its surrender, in the final balancing of international accounts after the imperial wars, early in the last century. Many laborers have migrated to North and South America in search of employment. Pop. 36,645.

DOMINICAL LETTER (from Lat. *Dominica,* Sunday), properly called Sunday letter, one of the first seven letters of the alphabet used in calendars to designate the Sundays throughout the year. The ancient Romans used the first eight letters. A–H, to denote their nundinal period of eight days; the early Christians dropped the eighth and adopted the remaining seven to indicate the days of the Hebrew week. These seven letters are employed to show on what days of the week the days of the month fall throughout the year. One of those seven letters must necessarily stand against Sunday, and is printed as a capital, and called the dominical letter or Sunday letter; the other six being inserted in different type, to denote the other six days of the week. Now, since a common Julian year contains 365 days, if this number be divided by seven (the number of days in a week), there will remain one day. If there had been no remainder it is obvious the year would constantly begin on the same day of the week; but since one remains, it is plain that the ordinary year must begin and end on the same day of the week; and therefore the next year will begin on the day following. Hence when January begins on Sunday, A is the dominical or Sunday letter for that year; then, because the next year begins on Monday, the Sunday will fall on the seventh day, to which is annexed the seventh letter, G, which therefore will be the dominical letter for all that year; and as the third year will begin on Tuesday, the Sunday will fall on the sixth day; therefore F will be the Sunday letter for that year. Whence it is evident that the Sunday letters will go annually in retrograde order, thus, G, F, E, D, C, B, A; and in the course of seven years, if they were all common ones, the same days of the week and dominical letters would return to the same days of the months. But because there are 366 days in a leap-year, if the number be divided by seven, there will remain two days over and above the 52 weeks of which the year consists. And therefore, if the leap-year begins on Sunday, it will end on Monday; and as the year will begin on Tuesday, the first Sunday thereof must fall on 6 January, to which is annexed the letter F, and not G, as in common years. By this means, the leap-year returning every fourth year, the order of the dominical letters is interrupted, and the series cannot return to its first state till after four times seven, or 28 years; and then the same days of the month return in order to the same days of the week as before. This method of indicating the days has held its place in Church calendars without variation from the beginning, and rules for finding them are given in breviaries, prayer books, etc.

DOMINICAN REPUBLIC. The Dominican Republic, West Indies, occupies the eastern and central portions of the island of Santo Domingo, or Haiti: bounded on the north by the Atlantic Ocean, on the south by the Caribbean Sea, on the west by the republic of Haiti, and separated by Mona Passage from

Porto Rico on the east. Area about 19,325 square miles.

The mountains — the centre and culmination of the Great Antillean uplift — form several cordilleras or roughly parallel ranges. The highest peak, Mount Tina (10,300 feet), is northwest of Santo Domingo City, and near the centre of the island are numerous peaks from 8,000 to 9,000 feet high. While the enormous mass of these mountains, occupying four-fifths of the island, renders much of the territory nearly inaccessible, between the ranges lie plains, some of which are wonderfully fertile, while others are without value for agriculture. Toward the north and west are the famous Vega Real and the sterile plain, Despoblado de Santiago; near the south coast the rich valley of Baní, which extends between the Nizao and the Ocoa; and in sequence the valleys of Azua, San Juan, or Antigua Maguana, Santo Tomé, Onceano, Hincha, Quava, and others. Toward the east, extending even to Cape Engaño is a region in which the *praderias* or *llanos* — valleys, meadows or plains — are most common. The ridge of the Cibao Mountains sinks to a height of only 1,000 feet at its eastern end.

The Ozama and Isabel rivers unite to form the port of Santo Domingo after receiving the waters of many smaller streams, such as the Yavacao, the Monte Plata and the Savita. The Haina, or Jana, which empties into the sea about 10 miles west of the capital, and the Nigua, whose course is still farther toward the west, enclose a very beautiful plain which was a source of wealth during the Spanish period. The Nizao flows southward between fields of sugar-cane and meadows where herds of cattle graze. Other rivers are the Artibonito, Yaquí, Yuna, Naranja, and Magua. The coast-line, about 940 miles in extent, includes the Bay of Samana — a well-sheltered harbor extending westward from the Mona Passage, its average width being 12 or 13 miles and its length more than 25 miles. This bay would accommodate the largest fleets, and defensive works placed at its entrance would make it practically impregnable. Its strategic value is so great that it should be reckoned one of the republic's chief assets. Other ports are: on the north, Puerto Plata and Monte Cristi; on the south, Santo Domingo and Azua.

The geology of the island is similar to that of the eastern ends of Cuba and Jamaica. There are four principal formations: «the older mountain rocks, of Cretaceous and Tertiary Age, made up of igneous rocks and clays, mantled by gravels and crystalline limestone; the white limestones of Tertiary Age; recent alluvial formations; and the coast limestone of elevated reef rock. No recent volcanic rocks are known.» The Spaniards obtained large amounts of gold and silver, especially the former, from mines worked during the early years of colonization. Recent reports made by American experts are not especially favorable with regard to these two metals. The fact seems to be that gold exists quite generally, but not in paying quantities owing to the high-priced labor. The profits of the old mines were won by the labor of native and African slaves. Copper, iron, manganese, platinum, tin, lignite, salt and petroleum are found; and the analogy of the Oriente mining region in Cuba would suggest that the deposits of the first three metals deserve particular attention.

The diversities of both soil and climate are greater than elsewhere in the Antilles. The Vega Real is fertile and well-watered; the Santiago plain, its western prolongation, is a desert. The soil of the western part of the plain of Seylo is gravelly, while that of the eastern part is composed of loams and clays. The country immediately surrounding Azua is barren; but the best sugar estates on the island are only three miles away; and the sugar-lands of no other West Indian island can quite rival in fertility the Dominican Republic's best. The climate of this country is healthful, like that of Porto Rico and other large islands in the West Indies. Trade winds blowing most of the year make the nights cool, and only a short part of the day must be called intensely hot, particularly in low-lying and sheltered regions. The dry season extends from the first part of December until June. During the other months the rainfall is as a rule abundant in the central and northern districts, especially in the northeast, which is probably the most fertile section of the entire country.

Cedar, lignum vitæ, mahogany, and other cabinet-woods and timber used in house- and ship-building, are taken from the forests. The most luxuriant growths, however, have no present commercial importance, because adequate means do not exist for bringing them from the interior regions to the coast. As in other parts of the Antilles, the forms of vegetable life are varied and of special interest, while the reverse is true of the fauna.

History.— Columbus on his first voyage to America visited the north coast of the island and left a few of his men. These were killed by the natives; but the colony of Isabel, established on his second voyage, endured until the colonists were transferred to a more healthful locality. The settlement on the south coast became eventually the chief city. Spanish settlements existed also at Concepción de la Vega, Puerto Plata, Santiago de los Caballeros and Bonao in the first decade of the 16th century. The cultivation of sugar-cane began in 1506. Three years later Christopher and Bartholomew Columbus were imprisoned by Bobadilla in the citadel of Santo Domingo. The natives were set to work in the mines and fields; and very soon shiploads of Indians were being transported from other islands to replace those who died under the hardships of this forced labor. Subsequently negroes were brought from Africa for the same purpose, a considerable number of black slaves reaching the colony before 1522. There was a short period of prosperity. Before the middle of the century, however, the most enterprising colonists were drawn away by the superior attractions of Mexico and Peru, and the country began to suffer from the attacks of English and French buccaneers, who established their headquarters on a small island near the northwest corner of Haiti. In the course of a century and a half the section west of the Despoblado, now known as the Republic of Haiti, was won for France. The Spanish government at the close of the 18th century abandoned the eastern section as well, the entire island passing first under French control; but soon afterward the

successes of Toussaint L'Ouverture and Dessalines united west and east in one country, independent of the European powers and governed by the black revolutionists of Haiti. Between 1809 and 1821 Spain again held the eastern section, and the old name Santo Domingo was revived with that limited application; but in the year last mentioned the inhabitants of the Spanish part of the island revolted. The eastern and western sections were united from 1822 to 1843, together forming the Republic of Haiti. The final separation took place in 1844, when the Dominican Republic was established. Spain reasserted her authority once more for a brief period (1861–65). With that exception, the many struggles through which the country has passed since 1844 have been due either to revolutions or to Haitian antipathy. In 1869 a treaty for the annexation of the Dominican Republic to the United States was negotiated during General Grant's presidency, but was defeated in the United States Senate. A revolution which drove President Báez into exile expressed the resentment of the Dominicans when this failure was made known. Comparatively good order was maintained for a few years, beginning in 1890, but the most violent methods were again employed by political leaders in 1898–99, and continued in 1902–03. President Jiménez was forced by a revolutionary uprising to resign his office in May 1902. His successor, Vásquez, was driven from power early in May 1903, after severe fighting, attended with heavy losses. Señor Morales became President in 1904. Defaults in the payment of interest to European holders of Dominican bonds brought on a crisis of a character so threatening that the United States was induced to take charge of the collection and administration of customs dues, acting in the capacity of a trustee, for the protection of the people of the republic and of their creditors. In 1911 President Cáceres was assassinated, and a revolution necessitated the resignation of his successor in 1912. Archbishop Nouel served as provisional President for part of a year. The next administration, that of President Bordas Valdés, included such events as the bombardment of Puerto Plata on two occasions by government forces and the agreement (1914) secured by an American mediatory commission for the establishment of a provisional government, with Dr. Ramón Báez as President. Elections were held under the supervision of the United States. Juan Isidro Jiménez was inaugurated as President 5 Dec. 1914. In April 1915, a new revolution broke out on the island and American gunboats were ordered to Santo Domingo City to maintain order. Revolution again became active early in 1916 and the revolutionists gradually extended the sphere of their operations. Jiménez found trouble also in Congress and he was finally impeached by the latter 1 May 1916, and, as a result, he resigned the presidency a week later; and on 15 May 2,000 American marines entered Santo Domingo City to guarantee free elections. The following June Congress appointed Jacinto de Castro President. Marines had also been landed at Puerto Plata owing to the activity of the revolutionists in that neighborhood and in other parts of the island. By an agreement reached with the revolutionists Francisco Henríquez y Carbajal was appointed provisional President (26 July), and at the general elections (15 August) he was elected President for a term of five months. Trouble broke out again and the United States intervened formally in the government of the country in November. The revolutionists were defeated by American forces at Macoris (29–30 November). Representatives of the United States government continued in control of the affairs of the Dominican Republic. A military commission was appointed early in 1917 to study the needs of the diplomatic service and the system of public education, and a claims commission was chosen to investigate all claims against the American government arising between the establishment of the American-Dominican convention of 1907 and the establishment of American control of affairs in November 1916, at which time all the principal Dominican executive ports were occupied by United States naval and marine officers. Order has been established throughout the country and trade, commerce and general business have improved very much under American control, which is exercised through a military government, in which the military governor combines the functions of Congress and President.

Government and Progress.— The constitution vests the executive power in a President chosen by an electoral college for a six years' term. Under the present constitution, which went into effect 1 April 1908, the Congress "designates a person to take charge of the executive office," in the event of the death or disability of the President. There is no Vice-President. The cabinet officers are the secretaries of Interior and Police, of Foreign Affairs, of the Treasury and Commerce, of War and Marine, of Justice and Public Instruction, of Agriculture and Immigration, and of Encouragement (Fomento) and Communications. The Congress is composed of Senate (12 members, one from each province) and Chamber of Deputies (24 members, two from each province), both senators and deputies being elected by indirect vote, the former for six and the latter for four years. The judiciary consists of a Supreme Court (eight members, appointed for terms of four years), two courts of appeal, etc.

Free primary instruction is offered by the communes, with the aid of the central government; the system including also superior technical and normal schools, and a professional school or university. There are about 40 newspapers. The State religion is the Roman Catholic, but there is toleration of other religions.

The legal currency has been the American dollar since 1900, but before the American intervention the country possessed a very inadequate amount of metallic and paper currency which has since been withdrawn. Certain native banks were invested with the power of issuing notes, but so great was the national distrust that their currency could not be disposed of. The circulating currency medium of the Republic is Puerto Rico and United States money. The chief banks are the Banco Nacional de Sto. Domingo and the Royal Bank of Canada. The International Banking Corporation acquired the established banking business of Santiago Michelena in the Dominican Republic, with

head offices at Santo Domingo City and several branches and agencies in other parts of the island. The Michelena Bank was the depository for customs revenues under the arrangement between the governments of Santo Domingo and the United States, and the International Banking Corporation succeeded to it in that capacity. There are also a few private bankers and merchants engaged in the banking business. The republic has two principal debts, both guaranteed by customhouse duties, one of $20,000,000 at 5 per cent interest and the other of $1,500,000 at 6 per cent interest. An additional debt of $243,000 makes the total indebtedness $21,743,000.in 1916. This debt is being steadily reduced since the United States assumed the management of the financial affairs of the republic. The government's revenue is derived from customs, alcohol and stamp taxes, wharfdues, posts and telegraphs, and civil registration. In the fiscal year 1916–17, total receipts were estimated at $4,468,000 and disbursements $4,406,567.

The principal exports of the Dominican Republic, which are rapidly increasing, are sugar, cacao, tobacco, coffee, hides, wax, honey, bananas and other tropical fruits, cotton, minerals, cabinet and other woods. The high price of sugar has stimulated the production of sugarcane, the yearly output of which, in normal times, is worth about $5,000,000. The cultivation of cacao and coffee is also on the increase, and more attention is being paid to the raising of cattle. The principal imports of the republic consist of iron, steel, cotton goods, wheat flour, rice, meats and dairy products, oils, raw and manufactured woods. The greater part of the export and import trade is now with the United States.

The railways of the republic have an extent of about 176 miles; private lines on large estates about 225 miles. There are 402 miles of telegraph and 847 of telephone lines. The difficulties of communication between the various districts of the country, primarily due to the cordilleras, are in large part attributable to the great lack of good highways, without which peace will never be assured. There is steamship service between New York and Dominican ports, but the vessels are, as a rule, small and slow. There is also regular steamer service between Santo Domingo, Porto Rico and Cuba.

A rural guard (nominally 906 officers and men) supplements a military force numbering about 1,300. The government has six small vessels, four of which are revenue cutters.

The number of inhabitants in 1917 was 724,500, or 37½ per square mile. The Despoblado region — the nearly uninhabited district of high mountains, inaccessible valleys and virgin tropical forests — comprises, roughly speaking, the central third of the entire area of the island, or one-half of the Dominican Republic. It is the wide borderland fought over by the Haitians and the troops of the Dominican Republic. The people of the latter country, of blended Spanish, Indian and negro blood, with the small proportion of white descendants of the Spanish colonists and foreign merchants, occupy an area that is actually much more restricted than a glance at the map would suggest.

The Dominican Republic is divided into 12 provinces. Among the principal cities of the country are Santo Domingo (the capital), 26,000; Santiago, 20,000; Puerto Plata, 16,000; San Pedro de Macoris, 15,000; Samaná, 6,000; Sánchez, 5,500; La Vega, 5,200; Agua, 5,000; Moca, 4,900; Monte Cristi, 4,500.

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MARRION WILCOX.

DOMINICAN REPUBLIC, Diplomatic Relations with. The United States first became interested in Santo Domingo through friendly trade arrangements secured in 1799 from Toussaint (the revolutionist), through Southern fear of the influence of free negroes from that island and in connection with the designs of Napoleon, whose failure there was a prominent cause of the American acquisition of Louisiana. Later, in 1822, the American government was interested in Santo Domingo's declaration of independence from Spain and its union with Haiti, but avoided formal recognition of a government founded on slave insurrection. Again in 1844 it was interested in the formation of the Dominican Republic (under Santana) by separation from Haiti, and the adoption of a constitution modeled on that of the United States, and was also attracted by the international importance which the new republic might have on account of its harbor facilities; but it withheld recognition and continued to refuse recognition until 1866.

From 1844 to 1860 American relations with the Dominican Republic centred around two questions: negotiation for a naval coaling station for American steamers and the danger of foreign intervention. In February 1845, in response to reiterated appeals for the American recognition and protection against Haiti, John Hogan was sent to report on conditions in the island. In 1846, D. D. Porter was sent on a similar mission with instructions to ascertain the value of certain privileges which the Dominicans were willing to accord. Later, in 1849, information was received that the Dominican Republic desired aid from the United States to frustrate European designs.

In 1851, the Dominican government having solicited the mediation of the United States, France and Great Britain to secure peace with Haiti, President Fillmore sent R. M. Walsh as a special agent to co-operate with the representatives of France and Great Britain in a remonstrance with the view of possible joint intervention to urge Haiti to stop the war and recognize the independence of the Dominican Republic.

Though the United States government,

under President Fillmore's administration, had the opportunity and power to obtain a foothold in Dominican territory, and was much in need of a naval station in Samana, its rule of policy was to avoid all disturbance of existing political relations in the West Indies, recognizing that any attempt of any great maritime power to get exclusive advantages might result in counter attempts of other powers, which would make the West Indies a theatre of national competition, and which might disturb the peace of the world.

The policy of the American government changed somewhat under President Pierce. Unsuccessful efforts were made to negotiate a general treaty. A treaty of amnity, commerce and navigation containing a secret article for the session of Samana Bay was negotiated by October, but it failed to receive the sanction of the Dominican Congress.

In April 1861, when it appeared that Spain by co-operation of President Santana had plans for the establishment of a protectorate in Santo Domingo or for annexation to Spain, the American government, through Secretary Seward, promptly gave warning that the President would oppose such enterprises on the American continent by persistent effective resistance. In 1863, in the struggle under Cabral against Spanish authority in the island, the American government remained neutral, but conditions finally induced Spain to abandon the island in April 1865, and the independence of the newly-established republic was recognized by the American government in September of the following year.

In the period of the American Civil War, in connection with the need of a naval base to meet difficulties in the blockade of Southern ports held by the Confederates, the American government became interested in San Domingo for its excellent harbor. Between 1865 and 1871 the question of the acquisition of a naval base at Samana, or of American annexation of the Dominican Republic, was a prominent one.

In 1869–70 the American government, acting on confidential information and invitation from the Dominican Republic, took steps to secure control of at least a part of the republic and, through General Babcock and the American consular agent, negotiated a treaty for the lease of Samana Bay and ultimate annexation, which was defeated in the Senate by a tie vote on 30 June 1870.

In 1871 President Grant, acting under a joint resolution of Congress, passed at his suggestion, appointed a committee of three (A. D. White, B. F. Wade and Samuel G. Howe), which, after investigation, recommended (April 1871) that Grant's policy had a good basis and should be sustained, but largely through the influence of Sumner, the Senate failed to adopt the resolution.

In 1896 Secretary Olney recommended that the missions to Santo Domingo and Hayti should be put on a plenipotentiary footing.

Late in 1899, after the assassination of Heureaux, who had been dictator for 17 years, the American government recognized the new de facto government. The Dominican government frequently invited the aid of the United States. In 1899 it invited a treaty arrangement for placing the unhappy republic under the protection of the United States, but the American government declined. In 1903 the American government declined a proposal made by a representative of a foreign government for joint fiscal control of Santo Domingo under an American receivership.

Near the close of 1904, certain European powers intimated that they would be compelled to resort to measures to coerce the Dominican government to pay its indebtedness to European creditors, unless the American government would arrange to collect the Dominican customs and guarantee an equitable distribution of the revenue. With credit destroyed, and the country on the verge of anarchy, President Morales appealed to the United States to shield his country from foreign interference.

In accord with a protocol concluded by President Roosevelt with Santo Domingo in February 1905, and under a consequent executive interim modus vivendi, an American receivership was established under the protection of the American navy. The result proved satisfactory in the improvement of conditions. The American Senate, which opposed the territorial-guarantee clause of the protocol, finally (in 1907) ratified a revised treaty which recognized the importance to the United States of orderly conditions in the island by authorizing the President to appoint a general receiver of the Dominican customs and to furnish any protection necessary.

The American policy — resulting in a practical test of the efficiency of the American government, in preserving order by intelligent direction, and in maintaining the Monroe Doctrine which had recently been criticised by German writers — undoubtedly prevented serious difficulties, removed the incentive to revolution, stimulated industry and labor, permitted the President to die a natural death and furnished new evidence in favor of the establishment of a permanent protectorate or right of intervention over the weaker Latin-American states, similar to that guaranteed by the Platt amendment in the American treaty with Cuba.

In outbreaks in 1912 and 1914, American commissioners were sent to restore order.

JAMES M. CALLAHAN.

DOMINICANS, or FRIARS PREACHERS, or PREACHING FRIARS (*Fratres Prædicantes*), the religious order founded by Saint Dominic. While laboring in Provence for the conversion of the Albigenses, Dominic associated to himself 16 disciples eager, like himself, to devote their lives to the work of reclaiming heretics and ministering to the spiritual needs of the poor and ignorant. In 1215 he visited Rome to obtain from the Holy See approval of the institute he proposed to form. Of the 16, 8 were French, 6 Spanish, 1 Portuguese and 1 English. The Pope (Innocent III), in conformity with the decree of the Fourth Lateran Council, then in session, against approval of new religious orders, refused again and again his consent, but at last promised to give his approbation on the condition that the friars should adopt as their own the monastic rule of the Augustinians. The condition having been fulfilled, the order was formally approved in 1216 by Innocent's successor, Honorius III. The order took definite shape in two general chapters at

Bologna in 1220 and 1221. The costume of the friars was to resemble that of the Augustinians, and to consist chiefly of a black cassock and rochet; but a few years afterward this was changed for the white habit and scapulary with outside black mantle, which is still the costume of the Dominicans. Their name Black Friars was given them because of the black mantle worn out of doors. The memory of their great monastery in London is preserved in the name Blackfriars Bridge. Houses of the new order were immediately founded in France, the Rhineland and Italy; and in 1221 was held the first general chapter of the order at Bologna in which were represented 60 convents of preaching friars. That same year arrived in England the first band of Dominicans, 12 of the brothers in charge of Gilbert de Fremey. At this chapter an addition was made to the rule of the order, by which the Dominicans were forbidden to hold any possessions or have any fixed incomes, but to live by the voluntary alms of the people; thus the Friars Preachers became mendicant friars like the Franciscans. All the universities were opened to the young scholastics of the order, and soon many preaching friars attained the foremost rank as philosophers, divines, canonists and scholars, although in later times the Jesuits largely displaced them as preachers and teachers. The master-general of the order is elected for 12 years, and is resident in Rome; and there are 52 provincials, elected for four years each. Their manner of life is one of great austerity. They took a conspicuous part in the Inquisition, the office of inquisitor in all countries being generally held by them. Among divines and philosophers the Dominicans Albert the Great, Thomas Aquinas and Raymond of Penaforte, the third general of the order, hold the highest places; the celebrated German mystics and divines, Meister Eckhart, John Tauler and Henry Suso, were Dominicans, as was also the martyr Savonarola. The great mediæval encyclopædic work, *Speculum Majus,* was the work of a Dominican, Vincent of Beauvais. The highest places in the Church have been occupied by Dominicans; since the order was founded there have been 4 Dominicans popes, 60 cardinals, over 150 archbishops and more than 800 bishops. A second and a third order were also founded by Saint Dominic; the second order being for women, and the third for men and women living in the world, engaged in secular pursuits and married. Saint Catherine of Siena and Saint Rose of Lima, d. 1617 (the first American saint), belonged to the order. (See TERTIARIES). The Dominican houses suppressed in England by Henry VIII numbered 58. Consult Drane, 'History of Saint Dominic, Founder of the Friars Preachers' (London 1891); D'Anzas, 'Études sur l'Ordre de Saint Dominique' (3 vols., Poitiers 1874–75); Jessop, 'The Coming of the Friars' (London 1888); Proctor (ed.), 'Short Lives of the Dominican Saints' (New York 1901).

DOMINIE SAMPSON, the schoolmaster in Sir Walter Scott's 'Guy Mannering.'

DOMINION OF CANADA. See CANADA.

DOMINIQUE. See DOMINICA.

DOMINIS, dŏm'ē-nēs, **Marco Antonio de,** Italian theologian and ecclesiastic: b. Arbe, an island in the Adriatic, 1566; d. Rome, 8 Sept. 1624. He studied in the college of the Jesuits at Loretto and in the University of Padua, and was made bishop of Segni in the state of Venice, 1596, and archbishop of Spalatro or Spalato 1598. Here he projected schemes for the reformation of the Church and unification of Christendom, but came into disfavor at the Roman court and had to quit, take refuge at Venice, where he made the acquaintance of Bedell, chaplain of the English embassy, afterward bishop of Kilmore in Ireland. De Dominis accompanied Bedell to England where he was regarded as a convert to Anglicanism, and through his influence obtained from King James the deanery of Windsor and other places in the Established Church. He was zealous for the overthrow of the papal system and published in London (1617) a work in Latin, 'De Republica Ecclesiastica,' designed to prove that the Pope possesses in the Church only a primacy of honor, not of jurisdiction. In 1619 was published his translation into English of Fra Paolo Sarpi's 'History of the Council of Trent.' His avarice made him unpopular in England, and in 1620 he opened negotiations with a view to a return to the ancient faith; and was finally brusquely ordered to leave the kingdom. He returned to Rome 1622, at the instance of the Spanish Ambassador at London, who led him to believe that he would be welcome there and would be raised to the cardinalate. He had published at Brussels a recantation of his subscription to the Anglican articles of religion, but his hopes of honors at Rome were disappointed, and in letters to his friends in England he recanted his recantation: but the letters never reached their destination, having been seized by the papal officers. He was thrown into prison by order of Urban VIII and there died 1624. After his death he was adjudged a heretic: his body was disinterred and burned, and the ashes thrown into the Tiber. In 1611 was published his tract, 'De Radiis Visus et Luces in Vitris Perspectivis et Iride' ('Of the Rays of Vision and Light in Perspective Glasses and the Rainbow'), in which is probably for the first time propounded the true theory of the rainbow.

DOMINIUM (Lat. *dominus,* a master) in Roman law, the right by which any one exercised control over property, and by which he was entitled to retain or alienate it at pleasure, as opposed to a mere life interest, or possessory or equitable right. *Dominium directum,* in feudal law, is the interest or superiority vested in the superior; and *dominium utile* is the interest in property vested in the vassal, which amounts to the right of merely using it (see SERVITUDES, USUFRUCT) as distinguished from that of his lord's ownership and supremacy.

DOMINO. See MASK.

DOMINO WHIST. See FIVE OR NINE.

DOMINOES, a game played with small flat oblong pieces of ivory, bone or wood, the full number of pieces being 28. They are marked with spots varying in number. Each domino has two sets of spots ranging in number from 0 up to 12, which are distributed in all possible combinations — 0–0, 0–1, 0–2, 0–3, etc., to 0–12; then 1–1, 1–2, 2–3, 2–4, and so on up to 12–12. Those which have the two sets of spots alike — 2–2, 3–3, etc.— are called double twos, double threes, etc. The game is to appearance

remarkably simple, but is played in a variety of ways. The general principle of all the varieties is that when one player leads by laying down a domino, the next must follow by placing alongside of it another which has the same number of spots on one of its sides. Thus if the first player lays down 6–4, the second may reply with 4–8, or 6–7, etc.; in the former case he must turn in the 4, placing it beside the 4 of the first domino, so that the numbers remaining out will be 6–8; in the latter case he must turn in the 6 to the 6 in like manner, leaving 4–7, to which his opponent must now respond. The player who cannot follow suit loses his turn; and as the object of the game, modified by special conditions in the different varieties, is to get rid of all the dominoes in hand, or to hold fewer spots than your opponent when the game is exhausted by neither being able to play, it is a special point of play to shut out your opponent when it can be done without injury to your own hand. The game, which is probably of Italian origin, was not known in Europe until well on in the 18th century.

DOMINUS, the Latin word which we commonly render by "lord," and which was a title given to the Roman emperor, but which more properly signifies the master of a house and his eldest son, as opposed to slave (*servus*). The Scottish "dominie," in the sense of schoolmaster, is of course taken from it, as is the same term in America, where in some places it is the title of a minister of the Dutch Reformed Church, and in others is applied to Protestant clergymen generally.

DOMITIA, dō-mĭsh'ĭ-ą, Roman empress: b. Gaul about 56 A.D.; d. Rome about 100 A.D. She was the daughter of Domitius Corbulo, a general of Nero's reign. She was married first to Ælius Lamia, but the Emperor Domitian took her for his wife. Finding that her new husband intended to have her executed she caused his assassination in 96 A.D. Her subsequent career is uncertain.

DOMITIAN, Titus Flavius Domitianus Augustus, Roman emperor: b. Rome, 24 Oct. 51 A.D.; d. there, 18 Sept. 96 A.D. He was a son of Vespasian and brother of Titus, and made himself odious, even in youth, by his indolence and voluptuousness and his cruel, malignant and suspicious temper. He became emperor 81 A.D. At first, indeed, he deceived the people by acts of kindness, good laws and a show of justice, so that their fears vanished; but he soon returned to his former excesses and cruelty. Agricola's victories exciting his jealousy, he recalled that general to Rome and kept him in total inactivity. At the same time he spread terror through Rome by the execution of a great number of the first citizens. He gave himself up to every excess and to the meanest avarice. He at last conceived the mad idea of arrogating divine honors to himself, assumed the titles of Lord and God and claimed to be a son of Minerva. His principal amusement consisted in the shows of the circus. The misery of the people was, meanwhile, continually increasing; and after the revival of the law against high treason, which enabled almost anything to be construed into this crime, no one was secure of his property or his life. A paper fell into the hands of his wife, Domitia, in which she found her own name and those of the two commanders of the Prætorian Guards, with many others, noted down by the emperor as victims. This discovery induced her to conspire against him and he was killed by a freedman named Stephanus.

DOMREMY-LA-PUCELLE, dôn-rā-mē-lă-pü-sĕl (original, Domremy; La Pucelle, that is, The Maid, has been added in honor of Joan of Arc), a small village in the department of the Vosges, in France, not far from Vaucouleurs, on the river Meuse. It is noted for being the birthplace of Joan of Arc (1410). The village contains a bronze statue of the heroine, and another monument to her and the cottage in which she was born still stands. A chapel on a neighboring hill marks the spot where she is said to have learned of her great mission. There is here also a museum. Domremy was exempted from taxation till the Revolution, in honor of the warrior-maiden, and in her honor also an annual pageant is held.

DON (Lat. *dominus*), a Spanish title of honor, originally given only to the highest nobility, afterward to all the nobles and finally used indiscriminately as a title of courtesy. It corresponds with the Portuguese Dom. During the Spanish occupation it was introduced and became naturalized in some parts of Italy, particularly in Naples.

Don is also a cant term applied in the universities of Oxford and Cambridge to a residential fellow or other college dignitary; and in the colleges of the United States to a professor or instructor.

DON, a river in the county of Aberdeen, Scotland. Its source is several small streams flowing from a bog about 1,900 feet above the sea. It flows east (parallel with the Dee) into the North Sea, a mile northeast of Old Aberdeen. It is about 82 miles in length. Its salmon fisheries are of considerable value.

DON (ancient TANAIS), a river of Russia which issues from Lake Ivan-Ozero, in the government of Tula, and flows southeast and southwest about 1,300 miles into the Sea of Azof, near the town of Azof, by three mouths, only one of which is navigable. Its ordinary breadth is from 500 to 1,850 feet, but it has a breadth of 18 miles during the spring floods, although droughts reduce it so much that it is very difficult in summer, even for light draught vessels, to negotiate the sandbanks and shallows. Generally speaking, the right bank is high and the left flat and low. The delta of the Don is an expanse of sandy flats, about 28 by 22 miles at the coast-line. Near its head is the important river-port of Rostov, and Taganrog also shares in the Don traffic. The Don has the most busy trade of all the rivers of South Russia, being navigable for 800 miles. The navigation is generally stopped by ice for about three months of the year; nevertheless, by means of its lower course, in connection with the Volga, the south provinces of Russia receive much Siberian produce and also manufactured goods from the interior of the empire. It has valuable fisheries. It is connected with the Volga by a canal. Its largest tributary is the Donetz or Little Don.

DON, or **DUN,** a river of the West Riding of Yorkshire, England, which rises near Cheshire, flows east and southeast and joins

the Ouse after a course of about 55 miles. By artificial cuttings and canals it has been rendered navigable for vessels to Sheffield, a distance of about 40 miles. From Snaith to Goole the channel is artificial and is known as the Dutch River.

DON CARLOS. See CARLOS.

DON CÉSAR DE BAZAN, dôn sā-zär dẹ bä-zän, the title of a French comedy by Dumanovi and Dennery (1844), founded on a portion of Hugo's play, 'Ruy Blas.' Don César is a ruined nobleman who changes his name, and in rags conducts himself with the happy, devil-may-care nonchalance of his better days. It is also the title of a comic opera by Massenet, produced in 1872.

DON GERARD, Dutch painter. See DOW, GERARD.

DON GIOVANNI, dŏn jō-vän'nē (Italian form of Don Juan, the name of the hero), the title of an opera by Mozart, considered his masterpiece, produced at Prague 29 Oct. 1787 (q.v.).

DON GIOVANNI, opera buffa in two acts by Wolfgang Amadeus Mozart (libretto by Da Ponte), first produced at Prague on 29 Oct. 1787. While a buffa opera according to the terminology of the day, or "*dramma giocoso,*" as Mozart called it, the buffa elements are transfigured by the power of genius and 'Don Giovanni' has been universally accorded recognition as one of the musical masterworks of all time. All of the great composers have paid it homage. Rossini, placing his hands solemnly on an autograph copy of the score, said: "He is the greatest, the master of them all; the only composer who had as much science as he had genius, as much genius as he had science"; while Wagner wrote: "Is it possible to find anything more perfect than every piece in Don Juan?" Based on an old subject, that has done service in many literatures, the book of the opera, in spite of certain weaknesses, is an admirable vehicle for musical treatment; but Mozart invested it with a tragic power that carried it to heights undreamt of by the librettist. The overture which at the outset prepares the way with its solemn chords and progressions was written in a single day — one of those miracles of musical creation of which Mozart performed so many. The opera is popularly assumed to be merely a string of musical numbers, connected by recitative, instead of a serious dramatic work; and the usual style of performance is largely responsible for this notion. As a matter of fact, Mozart excelled in dramatic characterization, and great as is the sheer musical beauty of the opera, still more wonderful, from the musician's standpoint, is its subtle reflection of character expression. One has only to recall the trio in the first act when the Commandant is killed, the duet "La ci darem," the serenade "Deh vieni," the drinking song "Fin ch'han dal vino," Zerlina's "Batti batti," to see how wonderfully the music heightens the power of the situations. The ballroom scene is a triumph of contrapuntal skill concealed under a simple exterior. The whole work is filled with touches that reveal the composer's genius at its best and superlatives fade before it. The orchestra, with the utmost economy of means, is as flexible and responsive an instrument as the great aggregations employed by the most modern composers. An excellent illustration of this is furnished in the accompaniment to Leporello's "Madamina" aria — the catalogue aria, as it is sometimes called. In 1825 Manuel Garcia, a famous singer, and the head of a remarkable family of musicians, brought an Italian opera company to New York. At that time Da Ponte, the librettist, then an old man, was living there — having left Europe to escape importunate creditors. He called on Garcia and on learning his identity, the singer clasped him in his arms and danced around like a child, singing "Fin ch'han dal vino." The opera was at once included in the repertory and it was produced on 23 May 1826, with Manuel Garcia himself in the title rôle and his daughter, later to become world-renowned as Malibran, and two other members of the family also taking part. Its success was immediate and permanent. In spite of the vast strides music has taken in the past hundred years, 'Don Giovanni' still remains an ever fresh fount of inspiration.

LEWIS M. ISAACS.

DON JUAN, dŏn jū'ạn, Sp. dōn hw-ān', the hero of a Spanish legend which seems to have some historical basis in the history of a member of the noble family of Tenorio at Seville. According to the legend Don Juan was a libertine of the most reckless character. An attempt to seduce the daughter of the governor of Seville brought the indignant father and the profligate don into deadly conflict, in which the former was slain. Don Juan afterward, in a spirit of wild mockery, goes to the grave of the murdered man and invites the statue of him erected there to a revel. To the terror of Don Juan the "stony guest" actually appears at the table to bear him away to the infernal world. The tale has furnished the subject for many dramas and operas. The legend first took definite form in Gabriel Téllez's 'El Burlador de Sevilla y Convidado de Piedra.' About 1650 versions of this drama appeared in Italy from the hands of Cicognini and Giliberto. In rapid succession appeared Dorimond's 'Festin de Pierre' (1658), De Villiers' 'Le festin de Pierre' (1660), Molière's 'Don Juan' (1665), the versions by Rosimond and Thomas Corneille, Cokain's 'Tragedy of Ovid' (1669) and Shadwell's 'The Libertine' (1676). It was used repeatedly as a theme for opera in Italy, first by Gluck, and later by Righini, Cimarosa, Albertini, Gazzaniga and others. The greatest of all, however, was Mozart's 'Don Giovanni.' In modern days the legend has been used by Prosper Mérimée in his 'Les Âmes du Purgatoire,' by Dumas in the drama 'Don Juan de Marana,' also by Byron, D'Aurevilly, Balzac, etc., and by Bernard Shaw in 'Man and Superman.' The best and most stirring modern treatment of this legend is that by José Zorilla, entitled 'Don Juan Tenorio: drama fantastico-religioso.' It has become universally popular in Spain, where it is staged annually in practically every playhouse in the country about the festivals of All Saints and All Souls on 1 and 2 November respectively. Consult Engel, 'Die Don Juan-Sage' (Dresden 1887); Farinelli, A., 'Don Giovanni, Note critiche' (Turin and Rome 1896); Gendarme de Bévotte, 'La Légende de Don Juan' (Paris 1906); 'Le Festiv

de Pierre avant Molière' (ib. 1907); Picatoste, 'Don Juan Tenorio' (Madrid 1883); Schroeder, Theodor, 'Die dramatischen Bearbeitungen der Don Juan-Saga in Spanien, Italien, und Frankreich, bis auf Molière einschliesslich' (Halle 1912); Victor Said Armesto, 'La Legenda de Don Juan' (Madrid 1908); Waxman, S. M., 'The Don Juan Legend in Literature' (in *Journal of American Folk-Lore*, Vol. XXI, New York 1908).

DON JUAN, a drama in prose by Molière, was first acted by his own company at Paris, 15 Feb. to 20 March 1665, with a success rivaled only by that of 'Tartuffe.' It aroused opposition at court hardly less bitter and tenacious, was withdrawn from the stage and first published, altered for the worse by the censorship, in 1682, nine years after Molière's death. Three copies of the unaltered version survive. An edition printed in Amsterdam in 1683 and reproduced in Brussels in 1694 presents the work in still earlier form before excisions had been made by Molière, after the first presentation, in hope of placating powerful offended offenders. Don Juan's origin is in an Andalusian legend of uncertain date. Here Juan Tenorio, a degenerate descendant of one of the Twenty-four of Seville, abducts the daughter of Commander d'Ulloa, kills him, insults his statue on his tomb, which coming to life sends Juan to subterranean flames. Early in the 17th century this legend was dramatized by Brother Gabriel Tellez of the Order of Mercy, under the name Tirso de Molina, as 'El Burlador de Sevilla y Convidado de Piedra' (The Seville Deceiver and the Stone Guest). This was adapted to Italian taste by Giliberto at Naples in 1652 and by Cicognini at Florence before 1664 with the title 'Il Convitato di Pietra.' One of these plays was acted in Italian at Paris in 1657. A French version by Dorimond was acted at Lyons in 1658, another by Villiers soon after at Paris, both with the inept and mistranslated title 'Le Festin de Pierre' (Peter's Feast). The subject proved very popular. Molière's company, unable to produce 'Tartuffe,' urged him to use it and 'Le Festin de Pierre' was the original title of the play now known as 'Don Juan,' written in evident haste, one of the most loosely constructed of his dramas, but for psychic penetration and strength in presentation of character ranking with 'Tartuffe' and 'Le Misanthrope' as chief among his comedies. The subject was treated dramatically in France during Molière's life also by Gueulette and Rosimond. Thomas Corneille versified and mollified Molière's prose in 1677. This version held the stage till 1841. Since 1847 the original Molière rules unchallenged in France. In episodes masterful but not dramatically linked 'Don Juan' presents an awesome picture of a wicked man of power, fascinating and abusing the despairing love of his wife, horrifying his ignorant and self-seeking but honest-hearted servant Sganarelle, whose part was taken by Molière, deceiving with facile protestations two fatuous peasant girls, tempting a distressful beggar to curse and tossing money to him at last with a jeer at "the love of humanity," showing physical courage in an encounter with robbers and moral bravado at the moving image of the murdered commander. Feigning hypocrisy as "a fashionable vice" that he may screen wickedness under the mantle of religion, he continues the same hard, cruel atheist, indifferent to, or taking a fiendish delight in, the suffering he inflicts, till clasping the hand of the statue he finds himself consumed by an invisible fire within. The earth swallows him as flames burst from the cleft in which he sinks. Sganarelle gasps, "My wages, my wages!" and adds a moral. Thus Molière fixed the type for the Don Juans of Mozart and Mérimée, of Musset and of Byron. The best editions of 'Don Juan,' both with accompanying comment and documents, are by Mesnard in Vol. 5 and Moland in Vol. 6 of their 'Œuvres de Molière.' Consult also Trollope, H. M., 'Life of Molière' (London 1905, pp. 371–394). There are good translations by H. Van Laun (Edinburgh 1875) and C. H. Page (New York 1908).

BENJAMIN W. WELLS.

DON JUAN, an unfinished poem by Lord Byron, somewhat difficult to classify, since it may be treated as a narrative-satire, a comic epic, a novel in verse, or — to employ its author's amusing description — a "versified Aurora Borealis." There is little doubt that it is one of the most original, brilliant and entertaining of modern books, fully entitled as such to the position given it by many readers and critics as the poet's masterpiece. From its first appearance, however, it has been severely censured by the more sedate and conventional portions of the British and American reading publics, both on account of the licentiousness of sundry scenes and passages and because of Byron's contemptuous and defiant attitude toward many of the beliefs, customs and institutions of sophisticated society. As one might naturally expect, the first objection is supported by the unprofitable use made of the poem by inexperienced readers and by persons of vitiated tastes, while the second objection has steadily lost force in more or less direct proportion with the liberalizing of society. Indeed, it may be held with some justice that the apparently increasing appeal made by Byron and by this masterpiece of his maturer years to seasoned and somewhat disillusioned readers who have reached or passed their prime is largely due to those features of the ebullient performance that originally suggested to conservative minds this second objection.

In length 'Don Juan' stands conspicuous among works in verse since it consists of 16 cantos and a fragment of a 17th, which aggregate nearly 2,000 eight-lined stanzas (*ottava rima*) and make, with the included lyrics, one of which is the famous 'Isles of Greece,' a total of a little over 16,000 verses. It was composed, with intermissions due to the remonstrances of the Countess Guiccioli and to the hindering attitude taken by publisher and friends, during a period stretching from the autumn of 1818 to the spring of 1823 — that is, from shortly after the completion of the successful 'Beppo,' which prompted the inception of 'Don Juan,' throughout the unregulated but far from unoccupied Italian years that saw the writing of 'Mazeppa,' of all the dramas save 'Manfred,' of 'The Vision of Judgment' and of several other important though less memorable poems. Publication was by instalments — Cantos I and II in July 1819; Cantos III–V in August 1821; Cantos VI–VIII, with John Hunt

as publisher of the remainder of the work in place of Murray, in July 1823; Cantos IX–XI and XII–XIV in August and December respectively of the same year; and Cantos XV–XVI in March 1824. Thus a few weeks before Byron succumbed to fever at Mesolonghi, the world had before it all of his masterpiece save the scathing dedication to Southey, which was added in 1833 after prior circulation as a broadside, and the fragment first published in our own generation. If the speed of composition had not quickened — Cantos VI–XVI were written between the early summer of 1822 and the early spring of 1823, we should probably not have had the brilliant satire of English life contained in the closing cantos, and we might even not have had the superb siege of Ismail or the picture of Catherine and her court. This would have meant a 'Don Juan' consisting only of the Donna Julia, the Haidée and the Gulbeyaz episodes, with the vivid shipwreck thrown in for good measure — still a great poem doubtless, but one which would have left a more sinister impression of licentious waywardness than the full poem leaves.

The chief literary influences discernible in the work — aside from Byron's continuous and apt use of details derived from his wide reading and apart from his employment of special sources of information in the shipwreck and siege cantos — are the "Whistlecraft" cantos of John Hookham Frere, which had prompted the writing of 'Beppo,' and the work of the Italian humorous-romantic poets Berni and Pulci. His best editor, Mr. Coleridge, thinks that he knew little of the Spanish "Don Juan," the legendary titanic embodiment of evil. The name, however, was attractive and suitable to a work that started off as a story of adultery in Spain. Once under way Byron seems to have had no settled plan except to take his hero on a tour — amorous, adventurous, humorous — through a great part or the whole of Europe. Spain, a Greek island, Constantinople and Ismail, Russia and England he lived to compass; one of his letters mentions projected escapades in Italy and Germany; perhaps, if he had lived to write the 100 cantos he jestingly planned, he would have ventured — with his extraordinary creative energy, versatility and daring — to embark his hero for the America of Washington and Daniel Boone, already praised in the poem; but all that is certain and important in this connection is that Byron made a not inconsiderable beginning of a comic epic, or whatever else we may call it, of many characters and scenes which, though frustrated by his death, became his chief and a real contribution to the "criticism of life." It is not the highest criticism of life that we encounter in 'Don Juan,' but it is a criticism that has its value to mature and catholic readers, a criticism presented through poetry that yields to nothing else in modern English literature in romantic passion and sentiment, in spirited action, in idyllic charm, in sham-annihilating satire, in cleverness and daring, and last — but far from least — in sustained energy and sincerity of creation, in unflagging carrying-power. His correspondence shows that he knew better than the naturally timid Murray and some of his other friends what superb poetry he was putting into "Donny Johnny," as he playfully christened his medley. He knew that it would be "known by and by for what it is intended — a *Satire* on *abuses* of the present states of Society, and not an eulogy of vice." We may dissent when he goes on to say that he cannot help it if it is "now and then voluptuous"; but it is at least time for us to recognize that such contemporaries as Goethe, Sir Walter Scott, Shelley and Washington Irving were far-sighted and healthy-minded in praising 'Don Juan' highly, and Southey the reverse in considering it "a foul blot" on English literature and "an act of high treason" to English poetry. Surely the world would be loth to spare such satire as "Oh for a *forty-parson power* to chant Thy praise, Hypocrisy" (X, 34), such sentiment as "'Tis sweet to hear" (I, 122), such idyllic beauty as is contained in the stanzas beginning "They looked up to the sky" (II, 185), such description as that of Lambro's home-coming (III, 27) praised by S. T. Coleridge, and of Newstead Abbey (XIII, 55), such effective denunciation of war as in the entire eighth canto — but to attempt to catalogue the great passages of this poem would be absurd. One stanza (XV, 99) "Between two worlds Life hovers like a star" would almost suffice of itself to make 'Don Juan' seem quite as much the work of a true poet as every page makes it seem the work of a shrewd man of the world. Probably no other modern long poem is so brilliantly sustained; no other characterized by such infinite and unstaled variety.

WILLIAM P. TRENT.

DON ORSINO, a novel by Francis Marion Crawford, published in 1892. The author's purpose is to describe a young man of the transition period in Rome after the unification of Italy. He chooses for his hero Orsino Saracinesca.

DON PASQUALE, päs-kwä'lą, an opera buffa in three acts by Gætano Donizetti (libretto by Salvatore Gammerano) first produced in Paris 4 Jan. 1843. The opera was an instant success, largely ensured by the original remarkable cast — Grisi, Mario, Tamburini and Lablache. The famous serenade, "Com'e gentil," sung by the tenor Mario to the accompaniment of a tambourine, which was introduced at the last minute, swept the audience off its feet. 'Don Pasquale' is one of the best light operas of the period. The scene is laid in Rome and the story, which is typically Italian, is concerned with the love of Ernesto for Norina, the interference of the wealthy Don, who has other matrimonial plans for his nephew, and the intrigue arranged by the mutual friend, Dr. Malatesta, which is so successful that the Don yields and blesses the nuptials of the young couple. The music is brimful of melody and merriment and flows along irrepressibly from first page to last. The solo numbers are primarily prima donna music, filled with the vocal hurdles that are a delight both to the bel canto singer who can successfully negotiate them and to the audience; the ensemble, including an unusually fine finale (second act), are no less noteworthy.

LEWIS M. ISAACS.

DON QUIXOTE, dŏn kwiks'ŏt; Sp. dōn kē-hot'a. To have written the book which for three centuries has best interpreted Spain to the world is the title to fame of Cervantes. Most artists in their view of life are merely personal; Cervantes is national and universal.

In him the genius of his people finds its best expression, yet his masterpiece speaks to all men irrespective of period or race. Books that do this may be counted upon the fingers of two hands, but among them is 'Don Quixote.' When it appeared in 1605, Miguel de Cervantes Saavedra was but two years short of sixty. A native of Alcalá, near Madrid, he had been a soldier in Italy and the Azores, a captive among the Barbary pirates of Algiers, and at home a dabbler in drama and pastoral romance, as well as a collector of taxes and of provisions for the Indies fleet. He had been imprisoned twice because an agent absconded, and once in La Mancha at Argamasilla de Alba, where tradition has it that he began his 'Don Quixote' in confinement. The original of his hero is said to have been Rodrigo Pacheco, whose portrait hangs there in the parish church in witness of his restoration from madness in 1601 by the grace of the Virgin. For 10 years after the publication of the first part of 'Don Quixote,' Cervantes did hack writing for the illiterate, and composed poems, plays and stories to please himself, while vainly seeking court favor. Then, on the appearance of a continuation to his great work by an Aragonese enemy calling himself Avellaneda, Cervantes hurriedly completed his authentic sequel, which was issued in 1615. In the next year, after producing a long heroic romance, he died.

That Cervantes was no enemy to the worthy romances of chivalry, this last effort — 'Los Trabajos de Persiles y Sigismunda' — makes clear. Yet it amused him to break a comic lance against the silly books in this kind which had succeeded the 'Amadis de Gaula.' He conceived the notion of showing a meagre, middle-aged gentleman, gone mad from the reading of such fantastic fictions, attempting to enact in the world of actuality the rôle of mediæval knight errant. This gentleman, taking the fancy name of Quixote or "cuish," sets forth upon his nag, Rozinante, to win glory for his lady, who is only a peasant wench. He makes three journeys. The first and briefest results in his being dubbed knight by a rogue innkeeper. The second, after his mischievous books have been burnt by his friends, a barber and a priest, involves also the misadventures of his squire Sancho Panza, an unromantic anti-hero who was invented as an amusing contrast to the valiant hero. From encounters with windmills and sheep, to the capture of a barber's basin that resembles the helmet of Mambrino; from the release of ungrateful convicts to a penance of love in the mountains, the experiences of the precious pair parody those of the old romances. At length the disguised barber and priest prevail upon the knight to enter a cage wherein he is brought home on a bullock cart, believing himself under enchantment. His third quest, filling the entire second part of the novel, is longest and most enjoyable. Here Don Quixote is surer than ever of his dignity and of the glory of knighthood; and Sancho is wittier, richer in proverbs and in common sense, loving, yet playing upon his master. The climax of interest is reached when a duke and duchess entertain the two, fooling Don Quixote to the top of his bent with elaborate pageants and arranging a mock island for Sancho to govern. Finally, the bachelor Samson Carrasco, who has already failed in one effort to fetch Don Quixote home, succeeds by overthrowing him in combat disguised as Knight of the White Moon. He is brought disconsolate to his house, having vowed to abandon knighthood for a year. He thinks to turn shepherd; but his heart is broken, and he recovers his reason only to part with life and the weeping Sancho.

Like other great works, this has been subject to various interpretations. Some have held it to be a satire directed against individuals — Charles V, Philip II, Ignatius Loyola or the Duke of Medina Sidonia. A Spaniard has pronounced it to be a mystic allegory, 'Dulcinea' being an anagram of 'Divina Luce,' or divine light. An Englishman — A. J. Duffield — has written a volume to prove it an attempt to expound the nature of madness. An Englishwoman — Mrs. Oliphant — regards it as Cervantes' confession of his own disillusionment with life. Many have seen here his design to present personified the two elements in human nature, soul and sense, poetry and prose. Thus Coleridge has said of Sancho, "Put him and his master together and they form a perfect intellect, but they are separated and without cement; and hence each, having a need of the other for its own completeness, each has a mastery over the other." Some have held that Cervantes sides with Sancho as ridiculing extravagance of feeling and imagination, Heine declaring that this is the greatest of all satires against human enthusiasm, and Sismondi calling it "the saddest book ever written." Others have maintained that Cervantes intends us to approve rather of Don Quixote whose faith and character rise superior to the ills of sense. But whatever interpretation be taken, it is certain that Cervantes was not exclusively either an idealist or a realist, that he and his age were not philosophic or likely to allegorize outside the domain of religion and that he was not a pessimist. It seems certain, too, that his masterpiece was not a carefully planned structure like the 'Divine Comedy,' but rather a spontaneous growth. Having set out to poke fun at absurd romances, Cervantes became interested in his burlesque hero; he took from popular literature and from observation the anti-hero as a foil, supplied adventures and a life-like dialogue as the best means for playing off one against the other, and, assuming the humorist's attitude, stood aside to smile at the delusions of both realist and idealist, favoring neither artistically. Thus his Don Quixote and Sancho developed from contrasted literary and social types to contrasted types that are national and universal.

'Don Quixote' is especially significant as a contribution to the novel and to the literature of the comic. Since it grafts upon the stock of old romance the element of observation of the actual, it is one of the first of modern novels. Although its plot is episodic and invertebrate, it reflects the world of men and nature with a precision nowhere earlier equalled outside of picaresque fiction. Landscape is given in a few strokes incidentally, but men are seen in great variety, especially the folk of the road. If most are drawn merely as to externals, the two principal figures are studied both within and without. They are consistent vital beings who can accept the test of any character; that is, they can be divorced from all they do and

remain alive. Their conduct in other situations can be predicated as exactly as that of persons whom we know. Character, indeed, is here more fully revealed than ever before in prose fiction, and the means for its revelation are not description and analysis but speech and action. Power of characterization through dialogue is Cervantes' greatest technical achievement.

As a comic epos, 'Don Quixote' is equally notable. For the comic is here present in all its phases, severally and combined, in unusual degree. The comic as burlesque is to be found in the parody of incidents from the romances of chivalry — the knight's watching of his armor, his decoction of a magic balsam, his voyage with Sancho in an enchanted bark, and their aerial flight astride a wooden horse. The comic as farce is to be found in incongruities of situation resulting from rude practical jests and confusions by night at inns. The comic as satire is to be found in assaults upon chivalric and pastoral follies, upon physicians, duennas and the governors of Spanish colonies. The comic as wit is to be found in an unflagging play upon words and ideas, as in Sancho's verbal mistakes and his wealth of proverbs. More noteworthy, however, than these four forms of the comic are two others — irony and humor — in which this novel excels. In irony the incongruous relation is emphasized negatively, as when Don Quixote, watching a puppet show, destroys the Moorish puppets that threaten the Christians, and then asks proudly, "Who now can doubt the good of knights errant?" In humor the incongruity concerns character, the humorist exhibiting with genial toleration the clash of inharmonious natures, as when Cervantes shows Don Quixote determined, in emulation of love-sick knights, to go mad and dash his head against a rock, whereupon Sancho, unable to understand his master's motives, begs the substitution of cotton, and promises to tell the lady that this substance was rock as hard as any diamond. Humor, indeed, marks the whole relationship of squire and knight, and even their conduct apart, as when the Don rejects the advances of the fair in order to remain true to his Dulcinea, or Sancho, having wisely ruled his island — a mere bend in a river — is fooled by a pretended martial attack upon it, and, relinquishing ambition, returns with relief to humble life. Here one feels a touch of pathos, but if there be any limitation in the humor of this work, it lies in the rarity of such moments wherein English humor abounds.

The influence of 'Don Quixote' has been extraordinary. Although the romance of chivalry was already dying or dead, and Byron was wrong in assuming that Cervantes "laughed Spain's chivalry away," this book, translated into all modern languages, has been the subject of countless allusions and hundreds of adaptations in the literature of the world. It has contributed more than any other single work to the development of prose fiction. To trace this influence in detail would require a volume.

Of 'Don Quixote' some 700 editions have appeared at home and abroad. In English the first translation was that of Thomas Shelton (1612). Other versions by Philips, Stevens, Motteux, Jarvis and Kelly were popular in their day but have been superseded by those of H. E. Watts (1888) and John Ormsby (1904). The influence of this novel upon English literature is studied by Gustav Becker in 'Die Aufnahme des Don Quijote in die englische Literatur' (1906). The standard English life of Cervantes is that by James Fitzmaurice-Kelly (1892).

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DONA FRANCISCA, Brazil, a German colony in the state of Santa Catharina, founded in 1851, lying between the Serra do Mar and the Atlantic Ocean, 14 miles inland from the port of São Francisco. Area, 550 square miles; pop. (1903) 21,000. Chief town, Joinville, with 3,000 inhabitants.

DONALDSON, Henry Herbert, American neurologist: b. Yonkers, N. Y., 12 May 1857. He was graduated at Yale in 1879, studied at the Sheffield Scientific School there, and also at the College of Physicians and Surgeons of Columbia University, and at Johns Hopkins. He was instructor in biology at the last-named institution in 1883–84 and associate professor of psychology there in 1887–88. In 1889–92 he was assistant professor of neurology at Clark University. He was professor and head of the department of neurology 1892–1906 and dean of the Ogden School of Science 1892–98 at the University of Chicago. Since 1906 he has been professor of neurology at the Wistar Institute of Anatomy and Biology, Philadelphia. He has written 'The Growth of the Brain' (1895); 'The Physiology of the Central Nervous System' (1896); 'The Rat' (1915), and articles in scientific journals.

DONALDSON, Sir James, Scottish educator: b. Aberdeen 1831; d. 1915. He was educated at Aberdeen University, New College, London, and Berlin University. In 1852 he was appointed tutor in Greek at Edinburgh University. In 1854–56 he was rector of the Stirling high schools and of those of Edinburgh in 1866–81. In 1881 he became professor of humanity at Aberdeen University, was made vice-chancellor and principal of the University of Saint Andrews in 1890 and principal of the United College of Saint Salvador and Saint Leonard. In 1907 he was knighted. His publications include 'A Modern Greek Grammar for the Use of Classical Students' (1853); 'Lyra Græca' (1854); 'Critical History of Christian Literature and Doctrine from the Death of the Apostles to the Nicene Council' (3 vols., 1864–66); 'The Ante-Nicene Christian Library,' in collaboration with Roberts (24 vols., 1867–72); 'Expiatory and Substitutory Sacrifices of the Greeks' (1875); 'Woman: Her Position and Influence in Ancient Greece and Rome, and Among the Early Christians' (1907); 'Addresses Delivered at Saint Andrews from 1886 to 1910' (1911).

DONALDSON, John William, English classical scholar: b. London 1811; d. 1861. He received his education at University College, London, and at Trinity College, Cambridge. In 1835 he was elected Fellow of the latter college. His earliest work was a revision of Buckham's 'The Theatre of the Greeks.' In 1839 appeared

the 'New Cratylus,' the first attempt on an adequate scale to familiarize the English-speaking world with the principles of comparative philology, the study of which had been so well advanced in Germany by Pott, Grimm and others. In 1841 Donaldson became headmaster of the grammar school at Bury Saint Edmunds. He continued his philological studies and in 1844 issued his 'Varronianus,' which did for Latin what the 'New Cratylus' had done for Greek. He also edited Pindar, Sophocles' 'Antigone,' with metrical translation, and wrote 'Maskil le Sopher,' a treatise on Hebrew grammar, and 'Jashar' (1854), a Latin work which, by tests, sought to distinguish the remains of early Hebrew songs in the Masoretic text of the Old Testament. In 1855 he returned to Cambridge and here wrote 'Christian Orthodoxy' in answer to the critics of 'Jashar.' He also wrote a 'Greek Grammar' and a 'Latin Grammar' for schools, both of which went through several editions. Donaldson became one of the classical examiners in the University of London in 1856 and two years later issued his 'History of the Literature of Ancient Greece' (3 vols., two of which are translations from the German of K. O. Müller). His health failed while working on the compilation of a new 'Greek Lexicon.' Consult Garnett in 'Dictionary of National Biography' (Vol. XV, 1888).

DONALDSONVILLE, La., town, county-seat of Ascension Parish, on the Mississippi River, and the Texas and Pacific Railroad, about 30 miles in an air line south of Baton Rouge. It is the trade centre of a cotton, rice and sugar-growing region, having large interests in these commodities and also in lumber. It is governed by a mayor and commissioners who are elected for a term of four years, subject, however, to recall by the electorate. The waterworks and electric-lighting plant are the property of the municipality. The town was settled in 1760 and was incorporated 46 years later. In 1863 it was burned by the Federals after a violent bombardment during the battle of Fort Butler. Pop. 4,090.

DONATELLO, or **DONATO DI BETTO BARDI,** Italian sculptor: b. Florence, between 1382 and 1387; d. there, 13 Dec. 1466. By his character and genius, by the historic importance and artistic quality of his work, he is one of the most original and grandest figures of the glorious *Quattrocento.* Since the preponderating rôle of naturalism in freeing modern art has been properly recognized, Donatello has been assigned his real place. In 1886 Florence celebrated, as a national event, the fifth centenary of his birth. At an early period he was greatly influenced by Brunellesco. The great models of antiquity also exerted a powerful influence over him. After a stay of two or three years in Rome he returned to Florence, where he began in earnest his career as sculptor. The first work in which Donatello impressed his personality was the marble statue of Saint Michael on the northern façade of the church of Or-San-Michele, together with its accompanying bas-reliefs. Another admirable piece of work are the three figures — Saint John the Baptist, David and Jeremiah on the west-façade of the campanile of Santa Maria del Fiore. Among the works belonging to this early Florentine period and in which he holds himself aloof alike from all servile imitation of the ancients and from the violent realism of some of his contemporaries we may note the statue and bust of Saint John in the Martelli palace, 'Christ in the Sepulchre'; 'Madonna and Child'; 'Jesus Christ giving the keys to St. Peter,' all in the Kensington Museum; the charming profile of Saint John in the Uffizi, and 'Head of a Young Girl,' in the Louvre. Donatello was very intimate with his patron and protector, Cosmo de Médici, and it is probably to his influence and to that of Ghiberti that are due certain works directly inspired by the ancients. Of these the bronze 'David' is the most noteworthy. The 'St. John' of the Uffizi and the 'Madeleine' of the Florentine baptistery are important as psychological studies rather than as works of art of a purely original type.

Donatello executed four monuments in collaboration with Michelozzo Michelozzi, the tombs of Pope John XXIII, Cardinal Brancacci, and Bartolomeo Aragazzi, also the bas-relief in bronze of the baptismal fonts in the Siena baptistery, all of which were completed between 1420 and 1432. In 1444 Donatello removed to Padua where he was destined to execute some of his most imperishable works, among others, the statue of Gattamelata, and the decorations in the basilica of Saint Antony. From 1450 to 1453 Donatello was engaged successively at Ferrara, Venice and Modena, after which he returned to Padua. In 1456 we find him at Ferrara and it was probably in the following year that he returned to Florence. Although now in advanced years, he was full of activity and it is without doubt between this date (1457) and his death that he executed many of the works mentioned above, also the bronze 'Saint John' at Siena, and the 'Four Evangelists' for the church of Saint Laurence, where the artist was buried close by his friend and patron, Cosmo de Médici. Donatello was the precursor of Michelangelo. Well versed in the craft of the ancients he preserved, to a degree even greater than Ghiberti, their great canons and simplicity.

Since 1886 the large hall at the Bargello has been exclusively devoted to the display of his works. Consult the biographies by Angelini, Carocci, Melani and Balcarres (London 1903), the best in English; also Vasari, 'Lives of the Painters, etc.' (English trans., New York 1912–16); Bode, 'Denkmäler der Renaissance skulptur Italiens' (Munich 1905), which contains a complete series of reproductions of the sculptor's works; id., 'Florentiner Bildhauer der Renaissance' (English trans., London 1808); Tschudi, 'Donatello e la Critica moderna' (Turin 1887).

DONATI, dō-nä'tē, **Giovanni Battista,** Italian astronomer: b. Pisa 16 Dec. 1826; d. Florence, 20 Sept. 1873. He was appointed in 1852 assistant at the observatory in Florence, of which he became director in 1864. Here he discovered, in addition to five others, the brilliant comet of 1858, which is known as Donati's comet, and proved the gaseous composition of these bodies. He was instrumental in erecting the fine observatory at Arcetri, near Florence, and constructed a spectroscope of 25 prisms.

DONATIO MORTIS CAUSA, in law, a gift of personal property made when the donor believes himself in imminent danger of death and to take effect only if he dies of the illness with which he was affected at the time he made such gift. There must be actual or constructive delivery of the property during the life of the donor to pass legal title. Only personal property is the subject of such a gift. This form of donation is convenient when it is difficult or impossible for the donor to make a will, and it is also claimed that it has been often used to evade the inheritance laws or death duties, as they are known in England and her colonies, now of increasing importance because their justice and expediency are recognized by most economic authorities and because of the probability that they will be adopted generally as they have been in Great Britain, Australia, New Zealand and many European countries. The gift, it will be seen from the foregoing, is conditional, and the recovery of the donor acts as a revocation without other formalities. By the civil law, delivery in all cases was not essential. Bills of exchange, notes and checks of third parties, and certificates of stock may be the subject of such a gift.

DONATION OF CONSTANTINE. An ancient document purporting to have been given by Constantine the Great in 324, out of gratitude for his healing from the disease of leprosy. It first appeared between the years 755 and 766. It was translated from the Latin text as follows: "We give as a free gift to our most blessed father, Sylvester the Pope, the city of Rome, and the cities of all Italy as well as the cities of other western countries. To make room for him we abdicate our sovereignty over all these provinces; and we withdraw from Rome, transferring the seat of our empire to Byzantium, since it is not just that a terrestrial emperor should retain any power where God places the head of religion." The document was exposed as a forgery by Laurentius Valla about the middle of the 15th century.

DONATISTS, a sect in the 3d century, and till the Vandal invasion a formidable opponent of the Roman Church in the Mediterranean provinces of Africa. The sect was not heretical, but was the first to separate from the Church on the ground of discipline. The sect arose out of dissensions at Carthage over the question of the readmission to church fellowship of those persons who in Diocletian's persecution had denied the faith either explicitly or implicitly by giving up to the persecutors the Christian sacred books. On that point they were extreme rigorists, as also in holding that a priest or deacon could not validly administer baptism if he were himself in a state of sin. When Mansurius was consecrated bishop of Carthage the faction headed by one Donatus repudiated him as a *traditor*—one who had given up the sacred books; and when after his death (311) Cæcilian became bishop of Carthage 70 Numidian bishops refused to have communion with him, as one that was consecrated by a *traditor*. They set up a rival bishop, Majorinus, and the schism grew steadily wider, being specially favored by the peasants. The schismatics were condemned by Melchiades, the reigning Pope, with three bishops of Gaul, in 313. This judgment was confirmed the next year by the Council of Arles, and in 316 by the Council of Milan, convoked under the protection of the Emperor Constantine. But the Donatists paid no heed and in 330 a council was held by 270 Donatist bishops, who denounced their opponents as heretics. The peace not only of the Church but of the civil state was seriously compromised by uprisings of the fanatical multitude against the Roman Catholics throughout northern Africa, to repress which the severe laws enacted by the emperors were ineffective. Saint Augustine, bishop of Hippo from 400 to his death in 430, labored zealously to restore peace to the Church. In 411 a conference with 279 of their bishops was held at Carthage at which Saint Augustine took a leading part, judgment being awarded by the imperial representative in favor of the Roman position. The sect early began to split up into independent smaller sects, they were deprived of civil rights in 414 and rigorously persecuted; they are little heard of after the Vandal invasion in 429, disappearing finally two centuries later before the Saracenic invasion of North Africa. Consult the works of Saint Augustine; Bright, 'The Age of the Fathers' (London 1903); Harnack, 'Der Ursprung des Donatismus' (Freiburg 1883); 'History of Dogma' (English trans., Boston 1894-1900); Sparrow Simpson, 'St. Augustine and African Church Divisions' (New York 1910).

DONATUS, dō-nā'tŭs, **Ælius,** Roman grammarian and commentator who lived in the 4th century. He wrote an elementary work on the Latin language, 'De Octo Partibus Orationis,' which served as a guide to the learning of Latin in the Middle Ages and formed the groundwork of most elementary treatises until recent times. It was one of the books most frequently printed at the commencement of the art, several editions having been issued from blocks even before the invention of types. Copies of these are among the rarest and most valuable of bibliographical treasures. He was also author of a commentary on Terence.

DONAU, dō'now. See DANUBE.

DONAUWORTH, dō'now-vĕrt, Germany, walled town of Bavaria at the junction of the Wörnitz and Danube, about 25 miles north by west of Augsburg. It contains saw mills, breweries and machine factories, and carries on a considerable trade in the agricultural products of the region. A great live-stock market, the largest in Bavaria, is held here monthly. The town received municipal rights in the 14th century, becoming a free city. In 1607, after friction between the Protestants and Catholics, it was occupied by the Bavarians who sided with the members of the Old Church. This action was one of the moving causes of the Thirty Years' War. The Bavarians lost a battle here to the Duke of Marlborough in 1704, and almost a century later, in 1805, it was again the battleground of the French and Austrians, the latter being worsted. Pop. (1910) 5,500. Consult Stieve, 'Der Ursprung des dreisigjährigen Krieges,' Vol. I, 'Der Kampf um Donauwörth' (Munich 1875).

DONCASTER, England, municipal borough in the West Riding of Yorkshire, on the Don, 32 miles south of York. Here are situated the locomotive and carriage works of the Great

Northern Railway. The municipality has been progressive in all forms of collective enterprise, gas, water, electricity, tramways and racecourse being owned by the town. It has long been famous for its annual races, begun in 1703. Nearby are the ruins of Conisborough Castle, the stronghold of Athelstan in Scott's 'Ivanhoe.' Pop. 30,516.

DONDO, dŏn'dō, West Africa, town in the Portuguese colony of Angola, situated at the head of navigation on the Coanza River and not far from the Loanda Railway. It has a considerable caravan trade and is an import coffee market. It is situated in a very fertile region, but the enervating climate of this portion of the Coanza district has given Dondo the unenviable name of "the furnace of Angola." Dondo has steamship communication with Loanda. Pop. 3,000.

DONDRAH, dŏn'drą, or **DONDERA HEAD,** the southern extremity of the island of Ceylon, a steep and rugged promontory, formerly the site of a temple.

DONEGAL, dŏn'ē-găl', Ireland, town at the mouth of the Eske, in the County of Donegal, 12 miles northwest of Ballyshannon. It is surrounded by hills and nearby are lofty mountains. Donegal Castle, ancient seat of the O'Donnells of Tirconnell, and the ruins of a Franciscan monastery, founded in 1474 by the first wife of Hugh Roe, are near the town. In this monastery were written the famous 'Annala Righeachta Eireaun,' or as they are better known, 'Annals of the Four Masters,' a record of Irish history to 1616, finished in 1636 by Michael O'Clery, a Franciscan monk, and his associates, two of whom were also named O'Clery. Pop. 2,647.

DONEGAL, Ireland (Irish, *Dun na nGall,* fort of the foreigners, i.e., the Danish corsairs), a maritime county in Ulster province, bounded on the north and west by the Atlantic Ocean, south by Leitrim and Fermanagh and east by Londonderry and Tyrone. Its area is 1,193,641 acres (about 1,868 square miles) and it has a much-indented coastline with numerous islands off shore. The land surface is mountainous and boggy and contains numerous loughs (lakes) and is traversed by numerous streams. About 35 per cent of the land is in pasture. Agriculture is the chief occupation of the inhabitants and is still carried on by primitive methods. Linen and woolen cloths are manufactured. The coastal population occupy themselves with the fisheries. The lakes inland are favorite haunts of the angler, being well stocked with salmon and other food fish. Since 1841 the population has declined steadily, being 296,500 in that year and only 168,537 in 1911.

DONELSON, Andrew Jackson, American diplomatist: b. near Nashville, Tenn., 25 Aug. 1800; d. Memphis, Tenn., 26 June 1871. He was graduated at the United States Military Academy in 1820, and entered the army as a lieutenant of engineers. In 1822 he resigned, studied law and also engaged in cotton raising in his native State. He was private secretary to his uncle, President Jackson, in 1829–30; Minister Plenipotentiary to Prussia and later to the federal government of Germany (1846–49); was editor of the Washington *Union* in 1851–52; was candidate of the American party for Vice-President, and after his defeat retired to private life.

DONETZ, dō-nyĕts', or **SEVERNOI DONETZ,** a river in Russia which, rising in the government of Kursk, flows almost due south about 670 miles into the Don, of which it is the principal affluent. It was navigable down to the 17th century, but is no longer so, except in time of floods, owing to forest denudation. In its basin are valuable coal mines.

DONGAN, Thomas, EARL OF LIMERICK, English colonial official: b. Castleton, County Kildare, Ireland, 1634; d. London, 14 Dec. 1715. After serving in the British and French armies he was appointed colonial governor of New York by the Duke of York in 1682. He gave the city of New York its first charter in 1686, and also conferred the first charter on Albany. He succeeded to the earldom of Limerick in 1698 on the death of his brother. A Catholic in religion, it was expected that, in conformity with his instructions, he would show great respect for French claims in America, but instead he disappointed the expectations of the French court by strenuously supporting the English colonists and claimed for England territory to the south of the Saint Lawrence and the Great Lakes, including sovereignty over the Iroquois. In 1688, after the treaty of neutrality between the French and English kings had been signed, Dongan was forced to resign, and was succeeded by Andros. After the dethronement of James II he suffered some persecution and did not return to England until 1691.

DONIPHAN, Alexander William, American military officer: b. Mason County, Ky., 9 July 1808; d. Richmond, Mo., 8 Aug. 1887. He was three times elected to the Missouri legislature. He served in the Mexican War, capturing Chihuahua after an unexpected encounter with an army of 4,000 men. He was one of the peace commissioners at the convention which met at Washington previous to the Civil War.

DONIZETTI, dō-nē-dzĕt'tē, **Gætano,** Italian composer: b. Bergamo, 25 Nov. 1797; d. there, 8 April 1848. He studied music at Bologna under the distinguished Abbe Mattei, and was for some time in the military service of Austria. His first opera, 'Enrico di Borgogna,' was presented at Venice in 1818. In 1822 his 'Zoraïde di Granata' gained him the honor of being crowned on the capitol. In 1830 appeared his 'Anna Bolena,' which first, with 'Lucrezia Borgia' (1834) and 'Lucia di Lammermoor' (1835), the latter the most popular of his works, acquired for him a European fame. In 1835 Donizetti was appointed professor of counterpoint at the Royal College of Naples, but removed in 1840 to Paris, bringing with him three new operas, 'Les martyrs,' 'La favorita' and 'La fille du régiment.' Of his other operas none except 'Linda di Chamouni' (1842) and 'Don Pasquale' (1843) achieved any special triumph. During the last four years of his life he suffered from insanity. He showed amazing fecundity in composition and was the author of 64 operas. He also composed with great rapidity, his 'Il campanello di Notte' (1836) being composed (music and libretto) and performed all within nine days; and the last act of 'La favorita,' his

acknowledged masterpiece, was composed in from three to four hours. He was exceedingly skilful in suiting the voices for which he wrote, had dramatic and comic talent of a high order and great melodic fluency. Consult Ferris, 'Great Musical Composers' (New York 1887).

DONJON, the grand or principal or commanding tower or keep of a mediæval castle, frequently raised on an artificial elevation. The donjon contained the great hall and principal rooms of state and also, on the lower or underground story, the prison fortress; whence the term dungeon.

DONKEY. See Ass.

DONNAY, dŏ'nā', **Maurice Charles,** French dramatist: b. Paris 1859. In 1891 he made his début with 'Phryne,' a Greek shadow play, and in 1892 produced an adaptation of the 'Lysistrata' of Aristophanes. In his later works he has abandoned the frivolous attitude so characteristic of his early work. He was elected to the Academy in 1907. His plays include 'Amants' (1895); 'Douloureuse' (1897); 'L'Affranchie' (1898); 'Le torrent' (1898); 'La bascule' (1901); 'L'Autre danger' (1901); 'Le retour de Jérusalem' (1903), a caricature of Max Nordau; 'La Patronne'; 'Menage de Molière' (1912).

DONNDORF, dŏn'dorf, **Karl Adolf,** German sculptor: b. Weimar 1835. He was a pupil of Rietschel in Dresden, and finished the Luther monument at Worms from this master's designs. Famous statues from his hand are those of Savonarola, Frederick the Wise, 'Valdues' and 'Mourning Magdeburg,' the equestrian statue of Grand Duke Karl August in the Fürstenplatz, Weimar. He also designed and executed the tombs of Robert Schumann in Bonn, the Kesstner family monument at Dresden, the statues of Peter Cornelius in Düsseldorf and of Bach in Eisenach, the 'Angel of the Resurrection' at Reineck Castle and the James fountain in New York. Among his most celebrated works are the busts of Bismarck and von Moltke in the National Gallery, Berlin, which are considered as the most characteristic likenesses of these leaders. Recent works of Donndorf are the equestrian statues of William I at Saarbruck (1904) and at Heidelberg (1905) and the national monument at Hohensyburg, Westphalia. In 1876 Donndorf was appointed professor at Stuttgart and in 1910 a Donndorf Museum was established at Weimar.

DONNE, dŏn, **John,** English poet and divine: b. London 1573; d. 31 March 1631. His father, John Donne, of a Welsh family, was an ironmonger; his mother, Elizabeth, was the daughter of John Heywood. His father died in 1575, leaving six children, whom the mother brought up in the doctrines of the Catholic Church. In October 1584 Donne entered Hart Hall, Oxford, where for a while his roommate was Sir Henry Wotton. After three years at Oxford he seems to have traveled on the Continent. In May 1592 he was admitted at Lincoln's Inn. For some time he shared his rooms with Christopher Brooke, the poet, through whom he apparently became one of the group of young London poets, and who later suffered a brief imprisonment for complicity in Donne's marriage. In 1593 Donne suffered for the first time some of that persecution which had pursued his family because of their Roman sympathies; his brother, Henry Donne, was arrested for sheltering a proselyting priest, William Harrington. Harrington was put to death at once and a few weeks later Henry Donne died of disease contracted in prison.

John Donne joined the expedition of Essex to Cadiz in June 1596. In August of that year he became secretary to Sir Thomas Egerton. Five years later he made a clandestine marriage with Anne, daughter of Sir George More and niece of Lady Egerton. His patron and his wife's father were exceedingly angry; he and the friends who had connived at the elopement were imprisoned, and all hope of advancement through Sir Thomas Egerton was lost. In a short time Donne was released from prison and forgiven, but he was penniless. For the next few years he lived on the charity of his friends, and at the beginning of the new reign he sought the king's favor. James recognized his ability, but, insisting that Donne was fitted for the Church, he promised only Church preferment, and Donne seems to have waited, in hope of a worldly career.

In 1611 he traveled on the Continent as the guest of Sir Robert and Lady Drury, upon the death of whose daughter Elizabeth he wrote the quaint 'Anatomie of the World,' remembered now by the three exquisite lines about "her pure and eloquent blood" that "spoke in her cheeks." On his return the following year he gave himself seriously to the study of theology. Ordained by the bishop of London in 1615, he became rector a year later of Keyston and of Sevenoaks. But a more important opportunity came at the same time, in the appointment as preacher to Lincoln's Inn. Here he immediately proved himself the most eloquent pulpit orator of his day. The death of his wife in 1617 saddened his life permanently, but he seems to have found a new ambition, far from worldly, in the use of the great powers he had discovered so late. His reputation as an orator was wide. While on a visit to Germany in 1619, as chaplain to Lord Doncaster, he preached in Germany and Holland to the admiration of his hearers. Shortly after his return to England he was made dean of Saint Paul's.

The last 10 years of his life were years of honor. His sermons as he preached them and published them were of extraordinary popularity, and still justify his fame. His great mind and broad experience of life had the added grace of the poet's temperament, and time sweetened his nature, which in youth at least was intellectually hard. Toward the end of his life his health gradually failed, and at his last sermon, preached before the king at Whitehall on Ash Wednesday, 1631, his hearers and he were conscious that he would never preach again. A few weeks later he died.

Donne's poems were published posthumously in 1633. Some of the pieces can be dated approximately by their context; most of them might have been written any time before the last 15 years of his life. The sacred poems, however, are naturally referred to the end and the secular poems to the beginning of his career; the satires probably belong to the time when he was seeking court favor and the epistles to the same time or slightly later. The

funeral poems are comparatively easy to date; the amatory elegies, it is to be hoped, were the work of youth.

Donne's reputation as a poet was great during his life, before his poems were published, and his love poetry shows not only marked individuality, but also the influence of minor schools of the time. In his early work he is clearly a Cavalier poet, yet his genius was not by nature fitted for that kind of song-writing. It has been said that he had no ear; his verse is harsh; and in spite of vigorous defense on the part of his admirers, the criticism constantly recurs. But perhaps it is truer to say that Donne had too much intellect for the kind of verse he wrote in; the brief Cavalier song was no room for his robust mind. Except for occasional lines of great beauty, such as those mentioned in the 'Anatomie of the World' and those of the lovely 'Break of Day,' his form of expression is cramped, and the poem as a whole displays no convincing proportion. So strong is the intellect in his verse, and so low is the emotional temperature, that thought and image, or even thought and word, rarely fuse; they frequently remain stubbornly unmated, however interesting each may be in itself. This is equivalent to saying that most of Donne's verse is fanciful rather than imaginative; and if it be added that he had little taste in selecting the image for his thought, it will be seen that he was by nature fitted to be one of the "fantastic" school — indeed the chief fantastic poet in English. At his worst, as in the ironical verses, "The Indifferent," in praise of inconstancy in lovers, he seems to search for novelty of idea at all costs, and the difficulty of his crowded lines offers little reward at last to the reader's patience. At his best, as in the famous "Valediction Forbidding Mourning," in which he compares the parted lovers to the pair of compasses, the ingenuity of the fancy gives a delight of its own; though its defect as poetry is clear in the fact that the attention is diverted from the poet and his poem to his astonishing conceit. The vogue of fantastic poetry gave Donne his audience; yet some of his verses have a smoothness and ease rare in him — such as the almost perfect song, "Sweetest love, I do not go," and the vigorous lines, "The Broken Heart," containing the ingenious image of the broken mirror, which Byron turned to his own good account.

An intellect so energetic as Donne's would not ignore such a strange fashion of thought as the Precieuse movement, transplanted from France by Henrietta Maria. The fantastic problems of that school as to the place of love in society, their perversions of Platonism, appealed to his genius. The influence is felt in several of his poems, but chiefly in 'The Ecstasy.'

Donne's sacred poems show the same general characteristics as the secular verse; the intellectual element is strong, so that their interest seems usually to be theological rather than religious; and the lack of constructive lyric form still mars any total effect. But the note of trifling, which went with the early fantastic images, is absent from this sacred verse; a great nature speaks seriously throughout, even though none of the poems are memorable. The best perhaps is the 'Litany.'

Of the elegies the ninth is the best, written in honor of George Herbert's mother. The others, like the Satires, are made upon Latin models, perhaps as academic trifling, but with the coarseness which the age easily forgave in Latin imitations. The epistles or "Verse Letters" are interesting for some of the persons to whom they were addressed — Christopher Brooke, Sir Henry Wotton, Isaak Walton, Ben Jonson.

It has been the fashion to praise Donne's poetry highly and to make a merit of its eccentricity. Its real merits, of an intellectual kind, are great, and were recognized by his age, but he was best known as a preacher. In the pulpit his keen intellect, his gift for striking expression and the force of a great personality deepened by time and suffering, found room for just expression.

Bibliography.— The best editions are those by Grosart, in Fuller's 'Worthies' Library'; Chambers, with an introduction by Saintsbury, in the 'Muses' Library'; and Grierson. For criticism, consult 'Introductions' to the above; Gosse, 'Life and Letters of John Donne'; and Ward's 'English Poets.' An annotated edition, edited by C. E. Merrill, Jr., of Donne's 'Letters to Several Persons of Honour' was published in 1912.

JOHN ERSKINE,
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DONNELLY, Eleanor Cecilia, American author: b. Philadelphia, Pa., 6 Sept. 1838. Among her volumes of verse are 'Out of Sweet Solitude'; 'Domus Dei'; 'Legend of the Best Beloved and Other Poems'; 'Crowned with Stars'; 'Hymn of the Sacred Heart'; 'Children of the Golden Sheaf and other Poems.' She has also written several prose works, including 'Life of Father Felix.'

DONNELLY, Ignatius, American prose writer and politician: b. Philadelphia, 3 Nov. 1831; d. Minneapolis, Minn., 2 Jan. 1901. He was prominent in Minnesota politics, being at one time lieutenant-governor of the State, and from 1863–69 a member of Congress, but was best known as an author. Among his writings are an 'Essay on the Sonnets of Shakespeare'; 'Atlantis, the Antediluvian World' (1882); and 'Ragnarök' (1883). In 'The Great Cryptogram' (1887). he endeavors to prove by means of a word-cipher that Francis Bacon was the author of Shakespeare's plays. His theory was further elaborated in 'Cipher in the Shakespeare Plays' (1900). His best-known novel is 'Cæsar's Column' (1890).

DONNELLY, Samuel Bratton, American printer and labor leader: b. Concord, Pa., 7 Nov. 1866. He was educated in the high schools of Lewiston, Pa., and the State Normal School, Shippensburg, Pa., and taught in the country schools of Franklin County, Pa., in 1883–86. In 1886 he began learning the printing trade and in 1895–98 was president of New York Typographical Union No. 6 and in 1898–1900 of the International Typographical Union, Indianapolis. He was secretary of the National Civic Federation 1901–02, and of the Joint Arbitration Board of the New York Building Trades Employers' Association from 1902 to 1908. From 1901 to 1908 he also served as commissioner on the New York city board of education and from 1908 to 1913 was public

printer at Washington. Since 1913 he has been again serving as secretary of the Joint Board of the New York Building Trades Employers' Association.

DONNER, dŏn'nĕr, **Georg Raphael,** Austrian sculptor: b. Essling, Austria, 25 May 1692; d. Vienna, 15 Feb. 1741. He studied at the Vienna Academy of Architecture, and was employed at the imperial court and also by Prince Esterhazy. Among his best works are the fountains on the Mehlmarkt and at the city hall, Vienna, a group of the Crucifixion in Gurk Cathedral and a statue of Charles VI.

DONNER, Johann Jakob Christian, German classical scholar: b. Krefeld 1799; d. 1875. He was educated at Tübingen and from 1843 to 1852 was professor at Stuttgart. He resigned to devote himself exclusively to literary work. He translated the Greek and Roman poets into German in their original metres. These translations include the satires of Juvenal (1821), Persius (1822), Sophocles (1838–39; 11th ed., 1889). This work is still the basis for nearly all the metrical translations of Sophocles. Other translations followed: Euripides (1841–53), Æschylus (1854), the 'Iliad' (1857), the 'Odyssey' (1859), Pindar (1860) and Aristophanes (1861), Terence (1864), Plautus (1865) and Quintus Smyrnæus (1866).

DONNYBROOK, Ireland, a parish now included within the parliamentary borough of Dublin, on the river Dodder. It was famous for its fairs, abolished since 1855, which used to attract vast multitudes and seldom passed off without riot and bloodshed. Pop. 19,472.

DONOGHUE, John, American sculptor: b. Chicago, Ill., 1857; d. New Haven, Conn., July 1903. He won a first prize over many competitors at the Chicago Fair for a classical group, 'Sophocles Leading the Chorus After the Battle of Salamis,' one of the finest specimens of the nude in American art. He designed the 'Saint Paul' in the Congressional Library in Washington, the 'Saint Louis of France' in the Appellate Division building in New York, and busts of Governor Ames and John Boyle O'Reilly in the Boston Public Library. Other works were his 'Venus' and 'Diana,' and best known of all, his 'Egyptian Ibis.'

DONOUCOLI, one of the small species of the South American monkeys of the genus *Nyctipithecus,* of which several species are to be found between Nicaragua and the Amazon; also called night monkeys and devil monkeys. They are small, rather thickly built, with short, round faces encircled by a ruff of whitish fur, very large, staring, yellowish eyes, and have close, soft, woolly fur, and bushy, non-prehensile tails. All are arboreal and nocturnal in habit, secreting themselves by day and hunting at night for the insects, small birds and fruits on which they feed; and uttering loud, cat-like howls. They make amusing pets, but are very delicate.

DONTENWILL, Augustin, Canadian bishop: b. Birschwiller, Alsace, 4 June 1857. He was educated in his native province and at Ottawa University. He entered the Oblate order in 1880; was consecrated coadjutor bishop of New Westminster, 22 Aug. 1897; bishop in 1899; first archbishop of Vancouver, 7 Sept. 1908; and resigned on his appointment, on the 20th of the same month, as superior-general of the Oblates, with the title of titular archbishop of Ptolemais. Resident in Rome.

DONUS, Pope from 676 to 678. He is known as a patron of architecture and adorned many of the churches of Rome; he also compelled the archbishop of Ravenna to recognize his authority. Sometimes a Donus II is recorded as Pope for a short time in 974, but this is recognized as a mistake, due to an error of a copyist.

DOO, George Thomas, English line-engraver: b. Christ Church, Hants, 6 Jan. 1800; d. Sutton, Surrey, 13 Nov. 1886. He made himself best known by his famous plates of 'Knox Preaching,' after Wilkie; of Eastlake's 'Italian Pilgrims Coming in Sight of Rome'; by his exquisitely finished heads of women and children, after Lawrence, and by his engravings from Raphael, Correggio and others. His plate of the Calmady children, titled 'Nature,' after Lawrence, produced in 1830, ranks as his masterpiece. He was court engraver to William IV and Queen Victoria, and in 1857 he was elected a member of the Royal Academy. About 1853–55 he painted in oils, his works of this class being mainly portraits. In 1864 he completed, after eight years' work, a large engraving of the 'Raising of Lazarus,' by Sebastiano del Piombo, his last important work.

D'OOGE, dō'gē, **Benjamin Leonard,** American university professor: b. Grand Rapids, Mich., 1860. He was graduated at the University of Michigan in 1881, and also studied at the University of Bonn. He was principal of the High School at Coldwater, Mich., in 1881–83, was instructor in Latin at the University of Michigan in 1884–85, and in the following year became professor of ancient languages at the Michigan State Normal College. He traveled and studied abroad in 1899–1901, and again in 1908–09. He edited 'Colloquia Latina' (1888); 'Viri Romæ' (1895); 'Easy Latin for Sight Reading' (1897); Cæsar's 'Gallic War' (1898), and 'Second Year Latin' (1899), with J. B. Greenough and M. G. Daniell; 'Helps to the Study of Classical Mythology' (1899); Cicero's 'Select Orations' (1901); 'Latin Composition' (1901); 'Latin Composition for Secondary Schools' (1904); 'Latin for Beginners' (1910; 2d ed., 1911).

D'OOGE, Martin Luther, American classical scholar: b. Zonnenarie, Netherlands, 17 July 1839; d. 12 Sept. 1915. He was graduated at the University of Michigan in 1862 and received the degree of D.Ph. at the University of Leipzig in 1873. From 1870 to 1912 he was professor of Greek in the University of Michigan. In 1878 he entered the ministry of the Congregational Church and was director of the American School of Classical Studies at Athens in 1886–87, and president of the American Philological Association in 1884. He edited Demosthenes' 'De Corona' (1888), and Sophocles' 'Antigone' (1885), and wrote 'The Acropolis at Athens' (New York 1909). He contributed also to various periodicals.

DOOLEY, Mr. See DUNNE, FINLEY PETER.

DOOLITTLE, Charles Camp, American soldier; b. Burlington, Vt., 16 March 1832; d. 1903. He entered the volunteer service during the Civil War, becoming colonel in 1862. He led

a brigade at Nashville, and was commander of the northern district of Louisiana in 1865. In June 1865 he was made major-general of volunteers and was mustered out of service in November of the same year. He moved to Toledo, Ohio, where he was cashier of the Merchants' National Bank.

DOOLITTLE, Charles Leander, American astronomer: b. Ontario, Ind., 12 Nov. 1843. In 1873–75 he took part in the survey of the northern boundary of the United States from the Lake of the Woods to the Rocky Mountains; during the 20 years following he was professor of mathematics and astronomy at Lehigh University, and from 1895 to 1912 was professor of astronomy in the University of Pennsylvania. His principal work has been in the branch of astronomy known as practical astronomy, on which subject he has written a well-known textbook for the use of advanced students. He was one of the first systematic observers of the variations of latitudes upon the earth, his research observations in this field having been begun in 1876 and continued with almost no interruption for a period of 35 years. During the last eight years observations were made on each night, both with the zenith telescope and with a very unusual instrument called a zenith tube, for the purpose of finding whether certain observed, small changes in the latitude of a station were real or whether they were due to imperfections in the instrument employed. It was found that these changes were indicated by the observations of both instruments. Dr. Doolittle is now professor emeritus in the University of Pennsylvania. He was treasurer of the Astronomical and Astrophysical Society of America from 1899 to 1905, and after 1909, a vice-president of the American Association for the Advancement of Science in 1893 and a curator of the American Philosophical Society.

DOOLITTLE, Eric, American astronomer: b. Ontario, Ind., 26 July 1869. He was graduated at Lehigh University in 1891, and became instructor in astronomy there in 1891–92; in the State University of Iowa 1892–93, and assistant professor of astronomy in the University of Pennsylvania 1896–1912, and professor of astronomy and director of the Flower Astronomical Observatory in the University of Pennsylvania since 1912. His principal contribution to astronomy from the theoretical side was a computation of the secular perturbations of the elements of the orbits of the four inner planets, employing in this work a method first fully developed by G. W. Hill and not hitherto applied in this connection. Outstanding, minute errors in the motions of these bodies, not fully accounted for by the distributing gravitational pull of the known planets, were verified by the new computation. His work in practical astronomy consists of a continuous series of measures of double stars, begun in 1895 and published in several volumes by the University of Pennsylvania, and in the labor of extending the 'General Catalogue' of S. W. Burnham (q.v.) and keeping this work complete to date.

DOOM, the old name for the "Last Judgment," a subject usually chosen for paintings over the chancel arch in parochial churches in England. Dooms were executed in distemper, and are of constant occurrence. In the reign of Edward VI these representations were effaced, or washed over, as superstitious.

DOOM PALM, or **DOUM PALM,** a palm-tree, *Hyphæne thebaïca,* whose branches terminate in a tuft of large fan-shaped leaves. It is a native of Arabia, is prevalent in Upper Egypt and central Africa and sometimes reaches a height of 50 feet. The fruit is about the size of an apple; it has a fibrous mealy rind, which tastes like gingerbread (whence the name gingerbread-tree sometimes applied to this palm), and is eaten by the poorer inhabitants of Upper Egypt, where it grows. An infusion of the rind, gently aperient, is also used as a cooling drink in fevers. The seed is horny and is made into beads and small ornaments. Ropes are made of the fibres of the leaf-stalks.

DOOMSDAY or DOMESDAY BOOK, the record of a statistical survey of England, made by royal authority in the reign of William the Conqueror. The origin of the name has been much disputed. Popularly it has often been associated with the final day of judgment. There was a doom-book or dom-boc (q.v.) composed in the reign of King Alfred, which contained a collection of the laws and customs of the kingdom, and the doomsday book is conjectured to have taken its name from the fact of its containing the authoritative data on which legal decisions in regard to land and other collateral property were to be given. The general survey of the kingdom was ordered at Christmas 1085, and completed in the following year. It was made by commissioners appointed by the king, who collected the particulars at inquests from a sworn jury, consisting of sheriffs, lords of manors, presbyters, bailiffs, villains; all the classes, in short, interested in the matter. The information collected consisted in specifications of the extent of land in each district, their proprietors, tenure and value; the state of culture, namely, the quantity of meadow, pasture, wood and arable land; in some counties the number of tenants, villains, *cotarii* and *servi;* even the sheep and cattle on the different estates were taken, but these were not entered in the permanent record. Northumberland and Durham were omitted and the northern part of Cumberland and of Westmoreland. The original 'Doomsday Book' is preserved in the record office. It consists of two volumes; one folio, one quarto. The republication of this valuable record was undertaken in 1767 and completed in 1783. Perfect facsimiles of the whole book in photozincography have also been made.

Taxes were levied on the basis of the doomsday book until 1522, when as a result of another survey, the 'New Doomsday Book' was compiled. 'The Victoria County History' gives a translation of the old doomsday text for each county with a commentary and map.

Consult Ballard, 'The Doomsday Boroughs' (Oxford 1904); and 'The Doomsday Inquiry' (London 1906); Ellis, H., 'General Introduction to Domesday Book' (2 vols., ib. 1833).; Maitland, F. W., 'Domesday Book and Beyond' (ib. 1897); Round, J. H., 'Feudal England' (ib. 1895); Vinogradoff, 'Villainage in England' (ib. 1892).

DOOM, a river in Ayrshire, Scotland,

which after a northwesterly course of 27 miles flows into the Firth of Clyde two miles south of Ayr. It is celebrated in the poems of Burns.

DOOR, a wooden or metal, sometimes stone frame or panel constructed to open and shut on hinges; used for entrances to buildings, rooms, etc. Sometimes made of one piece, but generally of several sections framed together. The doors of ancient Egypt and kindred countries swing upon vertical pintles which projected from the top and bottom of the door into sockets above and below. In China and other Eastern countries doors may be seen today swinging on pivots. In modern carpentry, doors are classified under two general heads: batten-doors and panel-doors. The former are made of two or more boards placed longitudinally and held together by transverse rails. The latter are formed of a skeleton frame work into which is fitted lengths of thin board called panels. Folding and sliding doors have been improvements upon the hinge variety, working on tracks or grooves and having the particular value of saving space. See also SWINGING DOORS.

The doors of antiquity are little known to us; the oldest in existence, those of the temple at Balawat, now in the British Museum, have their tenons sheathed in bronze. The doors of the Pantheon date from the 2d century; two of the Roman period are in the Lateran Basilica at Rome. The door of the church of the Nativity at Jerusalem (6th century) is covered with bronze plates; those of the church of Saint Sophia, Constantinople date from the 8th century. The doors made in Italy during the Renaissance period were of very simple construction; those in Germany and France during the same period were by contrast ornate and elaborately carved.

DOORGA, in Hindu mythology the principal wife (10-armed) of Siva, one of the gods belonging to the Hindu triad. She has many names and varied characteristics. In Bengal the name Doorga is her appropriate appellation, and was given her by transference from the giant Doorga, whom she slew. In this presidency a 10 days' celebration in her honor is annually celebrated. In southern and western India she is called Purwutee, or Parvati.

DOORNBOOM (*Acacia horrida*), a tree common in South Africa. The name "thorn-tree," given to it by the Dutch colonists, and the botanical specific name are due to the number and sharpness of its spines. It seldom much exceeds 30 feet in height, but its timber is hard and tough, and is much used for house-carpentry, etc. See ACACIA.

DOPE (from Dutch *doop*, sauce) is a descriptive term meaning any thick liquid like molasses; a thick sauce or gruel or other viscous fluid or pasty thing used for eating is called a dope. By extension used vulgarly for any narcotic or drug. Also (1) a thick pasty lubricant like axle-grease. (2) Fillers used in painting to fill the pores of the wood and prevent the absorption of the paint or varnish subsequently applied to the wood. (3) A preparation of pitch, tallow and other ingredients which, when applied to the bottoms of shoes, will enable the wearer to lightly glide over softened snow. (4) Any absorbent material, as cotton-waste for holding axle-grease or kieselguhr for holding nitro-glycerine. (5) A stupefying substance like opium or chloral hydrate. For dynamite dopes see EXPLOSIVES.

DOPPLER, Christian, Austrian mathematician and physicist: b. Salzburg, Austria, 30 Nov. 1803; d. 17 March 1853. He was professor of mathematics at Prague 1841–47, and at Vienna held a similar post in the Polytechnikum 1848–51. For the last two years of his life he was director of the physical institute at Vienna University. He published 'Ueber das farbige Licht der Doppelsterne' (1842); 'Versuch einer systematischen Klassifikation der Farben' (1848); 'Abhandlungen' (ed. by Lorenz, 1907), etc., and made known the noted "Doppler's Principle" (q.v.).

DOPPLER'S PRINCIPLE, a name given to the physical law (first enunciated in 1842 by Christian Doppler of Prague), that the apparent wave-length of sound or light depends upon the velocities of the observer and of the source from which the radiation proceeds. For the sake of illustration, let the source of the radiation be stationary with respect to the medium that transmits the waves, and let the velocity of the waves in this medium be V. If N is the number of waves of a certain definite wave-length that the source emits every second, then the observer will also receive N of these waves every second, provided he remains stationary. If the observer is moving, however, the case is different. For example, suppose that he is receding from the source of the radiation with a uniform velocity v, and consider what happens in the course of a single second. During this second N waves reach his initial position, just as before; but at the end of the second he is v units of distance beyond that initial position, and hence it is impossible that all of these N waves can have reached him. The deficit will evidently be equal to the number of waves whose combined lengths would just measure v. But the source sends out N waves every second, and when the last of these N is just leaving the source, the first one of the series has proceeded to a distance V. Hence we know that the length of one wave is $\frac{V}{N}$; and to find the number of waves that would be required to fill the distance v, we have only to divide v by the length of a single wave; that is, we have to divide it by $\frac{V}{N}$. Hence the observer's motion will diminish the number of waves that reach him every second by $\frac{Nv}{V}$, and, therefore, when he is receding from the source with the velocity v, he will receive only $N - \frac{Nv}{V}$, or $\frac{N(V-v)}{V}$, waves per second. The result will be, that the wave-length of the sound (or light) will appear to him to be longer than it really is. The same line of reasoning will show that if the observer is stationary and the source is receding with a velocity v, the

number of waves that the observer will receive per second will be $\frac{NV}{V+v}$. If the motion is such as to diminish the distance instead of increasing it, the algebraic sign of v must be reversed in the foregoing formulæ.

The most familiar example of Doppler's principle is afforded by the sudden change in the apparent pitch of a sounding bell or whistle on an express train moving at high speed. If the observer stands close to the track, the pitch falls suddenly and very markedly, as the locomotive passes him. The most important applications of the principle, however, are in astronomy, in connection with the measurement of the velocities of the celestial bodies, by observing the displacement that their motion produces in the positions of the lines of their spectra. (See SPECTROSCOPE). If the earth is approaching a heavenly body, the lines in the spectrum of that body are all shifted slightly toward the violet end, owing to the apparent shortening of each wave length by the motion. If the earth and the heavenly body are receding from each other, there is a similar displacement of the lines toward the red end. The rotation of Saturn's rings has been experimentally demonstrated in this way, and the velocities of approach and recession of many of the brighter fixed stars have also been determined. Certain stars have been demonstrated to be double, by the discovery that the lines of their spectra are periodically double and single; the lines appearing single when the relative motion of the two components is perpendicular to the line of sight, and double when the positions of the component stars are such that one star is approaching the earth while the other is receding from it. The orbits of certain of these stars have been determined by such measurements, even when the components of the systems are so close together that no telescope can show them separately, nor make them appear otherwise than as a single point of light. See DOUBLE STARS.

DOPPLERITE (named after Christian Doppler, the first to bring it to notice), an amorphous mineral occurring in elastic or partly jelly-like masses found in peat-beds in Styria and Switzerland, and regarded as a fossil peat. When fresh it is a brownish-black, with a dull brown streak and greasy subvitreous lustre, insoluble in alcohol or ether. Dopplerite is also the name of a related mineral, grayish, earthy and plastic in the fingers when fresh.

DOR, or BONGO (q.v.), the names given to a mixed tribe of negroes living in north central Africa, in the lowlands of the Bahr-el-Ghazal, Anglo-Egyptian Sudan. The race is of medium size, attaining splendid muscular development. Their skin is red-brown; they live in well-built huts, their main employment is agriculture, and they have the reputation of being industrious and amenable. The women tattoo the upper part of the body, and as ornaments wear rings and straws through the lips and nostrils. They are noted for remarkable productions in iron (which is their currency) and wood work. Consult Schweinfurth, 'The Heart of Africa' (London 1873).

DOR, or DORR, a species of beetle, belonging to the family of earth-borers; the cock-chafer of Europe. It is of a glossy violet, black or deep greenish-black. The club of the antennæ is yellowish, the elytra smooth, but slightly punctated, as is the thorax. It may often be seen flying about in the summer evenings. Its size and weight render it very unwieldy on the wing, so that it has but little power of guiding itself, and apparently none of checking its course quickly, for it strikes against all kinds of objects, but without suffering any hurt. The female lays its eggs in patches of cow-dung. It is about an inch long. It is also called dor- or dorr-beetle, dor-fly and buzzard-fly.

DOR, or MONT DORE, môn' dōr (often written Mont d'Or), a chain of mountains in France belonging to the group of the Auvergne Mountains, in the department of Puy-de-Dôme. They are of volcanic formation. The Puy-de-Sancy, the highest peak of central France, is 6,190 feet.

DORA, a facetious abbreviation of the British Defense of the Realm Act.

DORA D'ISTRIA, dēs'trē-ā, pseudonym of ELENA GHICA, Rumanian author: b. Bucharest, 22 Jan. 1829; d. Florence, Italy, 20 Nov. 1888. She married the Russian Prince Kolzow-Massalsky. Her first work, 'Monastic Life in the Eastern Church,' alleges monasticism to be the principal obstacle to civilization in eastern and southern Europe. Her other works include 'German Switzerland'; 'Women in the East'; 'Women, by a Woman.' She contributed many literary and historical essays to German, Italian, French, and Greek periodicals. Her studies on Albanian poetry gave rise to a nationalistic and literary movement among the Albanians.

DORCAS GAZELLE, the best known of the genus of gazelles, very common in northern Africa, Asia Minor, Arabia and Syria. It attains a height of two feet; has tapering ringed horns from 9 to 10 inches long; and is of a tawny color with white under parts. It is noted for its speed, is naturally very wild, but easily becomes domesticated, and owing to its beauty and gracefulness is frequently alluded to in Oriental poetry. Its name is derived from the Greek *δορκὰς*, through *δέρκεσθαι*, to look, owing to the size and brightness of its eyes.

DORCHESTER (ancient Roman DURNOVARIA or DURINUM), England, a municipal borough, the county town of Dorsetshire, six miles north of Weymouth. It has a considerable agricultural trade, and cavalry and infantry barracks. In March 1645 Cromwell held the town as his headquarters with 4,000 men, and in 1685 Judge Jeffreys held his "bloody assize" here, when 292 received sentence of death as being implicated in Monmouth's Rebellion. A Roman amphitheatre, in a good state of preservation, is near the town. Pop. 9,842.

DORCHESTER, Mass., since 1870 one of the wards of the city of Boston. Dorchester, originally called Mattapan, was settled in 1630 by the Puritans, but the name was soon changed to Dorchester in memory of the English home of some of the settlers. Dorchester was settled before Charleston and Boston. In 1633 its territory or township extended almost to the borders of the Rhode Island Colony, over 35 miles distant, and was then known as

«ye greatest towne in New England.» Here the form of special township government, since so characteristic of New England, was first instituted. The town of Windsor, Conn., was founded in 1636 by Roger Ludlow and a company of Dorchester citizens and toward the close of the century, in 1695, it sent another colonizing company to South Carolina. It was by fortifying Dorchester Heights in March 1776 that Washington forced the evacuation of Boston by the British army. The place is noted as the birthplace of Edward Everett. The population is counted as a part of that of Boston.

DORCHESTER, New Brunswick, town, county seat of Westmoreland County, at the junction where two small rivers enter Shepody Bay, and on the Intercolonial Railway. The industries are principally ship-building and nearby quarrying, from which great quantities of building stone are exported. Coal and lumber are also exported in large quantities. It contains a woolen mill and the penitentiary of the Maritime Provinces. It has an excellent harbor. Pop. 1,080.

DORCHESTER HEIGHTS, now **SOUTH BOSTON,** Mass. This hill on the peninsula, southeast of Boston proper, across a navigable channel, commands the city; and in the Revolution, when Boston was held by Howe in the winter of 1775–76, it was obviously of the first importance to fortify it. Howe neglected to do so, and on the evening of 4 March 1776, under Washington's orders, Gen. John Thomas, with some 2,500 men and the proper implements, took possession of the heights, and by the next morning a sufficient entrenchment had been thrown up. Howe promptly agreed to evacuate Boston if unmolested, and did so on the 17th, leaving all his guns and supplies unharmed for the Americans.

DORDOGNE, dôr'dōn'yĕ', a department of southwestern France, which includes the greater part of the ancient province of Périgord, and small portions of Limousin, Angoumois and Saintonge. Area, 3,550 square miles, of which about a third is fit for the plow. The chief minerals are iron, which is abundant, slate, limestone, marble and other stone. Mining, iron manufacture, etc., are carried on to a considerable extent, and there are a number of vineyards. Also noted for its production of wines and truffles. The climate is mild, but somewhat changeable. The river Dordogne, principal river of the department, rises on the flanks of the Puy-de-Sancy, flows west-southwest, and after a course of 305 miles unites with the Garonne in forming the Gironde. Pop. 437,432.

DORDOGNE, a river of south central France, formed by the union of the Dor and Dogue at the base of Mount Dore and flowing west for 305 miles, uniting with the Garonne about 15 miles north of Bordeaux. The river is navigable for steamers for nearly 190 miles.

DORDRECHT, dôr'drĕHt. See DORT.

DORÉ, dō'rā', **Paul Gustave,** French artist: b. Strassburg, 6 Jan. 1832; d. Paris, 23 Jan. 1883. He early showed signs of remarkable artistic talent: after his fourth year he was seldom without a pencil in his hand, and in his 11th year he executed drawings on borrowed lithographic stones. In 1847 he was sent to the Lycée Charlemagne at Paris and presently his remarkable skill as a designer and draughtsman of humorous and satirical subjects gained him a place among the illustrators of the *Journal pour Rire.* From 1848 to 1853 he contributed to the Salon a series of pen drawings which attracted much attention. In 1857 he obtained honorable mention for his landscapes and a picture of the Battle of Inkermann. Meantime his fame as an illustrator of books was rapidly rising, and it is in this branch of art that his fame is mainly founded — one in which his strongly marked individuality, pictorial and decorative sense, grotesque humor and vivid imagination found full play. He began his embellishment of the world's literary masterpieces by his drawings for Balzac's 'Contes drolatiques' (1856); followed by illustrations for Montaigne (1858), the 'Inferno' (1861); 'Don Quixote' (1863); the 'Purgatorio' and 'Paradiso' (1864–66); and the Bible (1865–67). His productivity was extraordinary, and included paintings in water colors and oils and sculpture. After 1870 he painted for the most part Scriptural subjects; and on the strength of his large canvas, 'Christ Leaving the Prætorium,' he was hailed in England as a great poet-preacher and enjoyed a great vogue in that country, and a permanent gallery of his work was established in London. Some of his canvases were so large that he had to erect ladders and scaffolding in his studio in order to reach them. In sculpture his most successful essays were the colossal vase now in the Golden Gate Park at San Francisco and the monument to Alexandre Dumas in the Place Malesherbes, Paris.

Doré's juvenile and adolescent successes reacted disastrously on his after-career. They prevented him from applying himself steadily to a mastery of the technique of drawing; he lacked self-control; from first to last he was deficient in interpreting the subtleties of expression; he attempted to excel in too many fields; and so great was the market demand for his work that he wore himself out by overproduction. He was appointed a Chevalier of the Legion of Honor in 1861 and an officer of the Legion in 1879. Consult Beraldi, 'Les graveurs du 19ième siècle' (Paris 1885); Delorme, 'Gustave Doré' (ib. 1879); Jerrold, B., 'Life of Gustave Doré' (London 1891); Roosevelt, 'Life and Reminiscences of Gustave Doré' (New York 1885).

DOREMUS, Charles Avery, American chemist: b. New York City, 6 Sept. 1851. He was graduated at the College of the City of New York in 1870 and took the degree of D.Ph. at the University of Heidelberg in 1873. In 1874–79 he was a member of the faculty of Bellevue Hospital Medical College; from 1879 to 1882 was professor of chemistry and toxicology at the University of Buffalo. In 1882–92 he was professor of chemistry at the American Veterinary College, New York, and from 1892 to 1904 was connected with the department of chemistry of the College of the City of New York. He is a patentee of a process for softening water, for a gas furnace, another for producing hydrofluoric acid, and for extracting alumina from clay and for the extraction of potash from feldspar. He is

author of 'Report on Photography, Vienna Exposition' (1873); section on gaseous poisons in 'Textbook of Legal Medicine and Toxicology' (1903); and contributions to various scientific journals.

DOREZ, do'rē', **Léon (Louis Marie),** French author and librarian: b. Villemaur, Aube, 1864. He was educated at the École des Hautes Études, the Sorbonne and the École des Chartes. In 1893 he was connected with the French School at Rome, and later received the appointment of assistant in the Bibliothèque Nationale, and in 1905 became librarian of the manuscript department there. He edited the *Revue des Bibliothèques* and the 'Bibliothèque littéraire de la Renaissance.'

DORIA, dō'rē-ā, one of the most powerful families of Genoa. It became distinguished about the beginning of the 12th century and shared with the families Fieschi, Grimaldi and Spinola the early government of the republic. These four were known as *Magnæ quatuor prosapiæ,* the four great families of this republic. The Dorias and the Spinolas belonged to the Ghibelline, the Fieschi and the Grimaldi to the Guelph faction; but as this division does not exhaust the combinations of which the number four is capable, the two distinct sections entertained their own private jealousies and quarreled among themselves, Guelph with Guelph and Ghibelline with Ghibelline, making, as it were, a bear-garden of the dark and deep streets of their formidable city.

DORIA, Andrea, Genoese admiral: b. Oneglia, 30 Nov. 1468; d. Genoa, 25 Nov. 1560. He entered the Pope's guards and afterward passed into the service of the Duke of Calabria, who commanded in Italy for the king of Aragon. He was rapidly promoted, and Alphonso II gave him a command against Ludovico Sforza, Duke of Milan. When the French had left Italy the Genoese entrusted the reconstruction of their fleet to Doria. He was first employed in suppressing the Barbary pirates, from whom he captured a large booty, but was soon after exiled, and entered the service of Francis I, who named him admiral of the French galleys. Displeased with some demands of the French king, who in answer to his complaints deposed him from his command, he entered the service of Charles V in 1528. His defection proved disastrous to the French cause in Italy. He occupied Genoa without resistance on 12 Sept. 1528, and his further successes contributed to the re-establishment of peace. He re-established order in Genoa and organized the government on a new basis, which became permanent during the independence of the republic. Charles bestowed on him the highest honors and received in exchange the most important services. In 1532 he took Koron and Patras, in Greece, from the Turks, and in 1535 assisted in the capture of Tunis. He assisted next year in a descent on Provence, took Toulon and ravaged the coasts of the Gulf of Lyons. The emperor and the king of France had afterward an interview, which has become historical, on board his galley, with a view to the conclusion of peace. This interview took place at Aigues-Mortes in July 1538. In 1547 he narrowly escaped assassination in a conspiracy raised in Genoa by the Fieschi. His nephew was killed in this conspiracy, which excited him to some severities approaching to the barbarity of earlier times. Doria has been accused, probably with justice, of selling his sword too freely, and to too many opposing interests; but his services to his country have earned him the titles of *father* and *liberator,* which were conferred on him, together with the censorship for life, by the Genoese Senate in 1528. Consult Guerazzi, 'Vita di Andrea Doria' (Milan 1874); Petit, 'André Doria' (Paris 1887).

DORIAN MODE, the standard Greek and ecclesiastical mode, the first of the authentic Church tones or modes, from D to D, with its dominant note of A. It resembles the key of D minor, but with the B natural and no C sharp. It is characterized by its severe and austere progressions and is especially adapted to religious or warlike music. Many of the old German chorals are written in this mode.

DORIANS, one of the four great branches of the Greek nation. They derive their name, according to legend, from Dorus, the son of Hellen. They dwelt first in Histiæotis, were then driven by the Perrhæbi into Macedonia, forced their way into Crete, where the lawgiver Minos sprang from them, built the four Dorian towns (Dorica Tetrapolis) at the foot of Mount Œta, between Thessaly, Ætolia, Locris and Phocis, and subsequently, together with the Heraclidæ, made a settlement in the Peloponnesus, where they ruled in Sparta. Colonies emigrated from them to Italy, Sicily and Asia Minor. The Dorians were in many ways the reverse of the Ionians. The Doric manner always retained the antique style, and with it something solid and grave, but at the same time hard and rough. The Doric dialect was broad and rough; the Ionic delicate and smooth; it was the form made use of in solemn odes, for example, in hymns and in choruses forming part of the national celebrations and the acting of the drama at Athens. This use of the word has been perpetuated; i.e., the Scottish dialect, in contrast with the more polished literary English, being called Doric. The Cretan and Spartan legislative codes of Minos and Lycurgus were much more rigid than the mild Athenian institutions of Solon. The Spartan women wore the light tucked-up hunting-dress, while the Ionian females arrayed themselves in long sweeping garments. Both have been idealized by artists: the one in Artemis and her nymphs, the other in Pallas Athene and the Canephoræ. The same contrast appears no less strikingly in their architecture, in the strong, unadorned Doric and the slender, elegant Ionian columns. See Müller, 'Die Dorier'; Grote, 'History of Greece.'

DORIC ORDER, in architecture, the second of the five orders, being that between the Tuscan and Ionic.

Grecian Doric.—The Doric column was first adapted to edifices having the proportions, strength and beauty of the body of a man. The trunks of trees probably suggested the first idea of columns, but in the Doric style the proportions of a man appear to have been adopted. A man was found to be six times the length of his foot, hence the plain Doric columns were made six diameters in height. From the middle of the 7th century to the end of the 6th century B.C., the Doric appears to have been the only

style of architecture used by the Greeks, and its highest example is the Parthenon of Athens.

Roman Doric.— An imitation of the Grecian, with a true Greek entablature and a molded base. The column is slenderer than that found in the best Greek examples, and is possibly of Etruscan proportions.

DORIDÆ, in natural history. See SEA-LEMON.

DORIGNY, dō-rēn-yē, **Louis,** French engraver: b. Paris 1654; d. Verona, Italy, 1742. He was a son of Michel Dorigny (q.v.). He entered the school of Lebrun and made a journey to Italy, where he copied the great masters.

DORIGNY, Michel, French painter and engraver: b. Saint Quentin 1617; d. Paris 1665. He was a pupil of Simon Vouet, whose works he etched and whose faults in drawing he copied. His style of execution is bold, and his management of light and shade good. He became professor in the Academy at Paris.

DORIGNY, Sir Nicholas, French engraver: b. Paris 1658; d. there 1746. He was a son of Michel Dorigny (q.v.). He spent 28 years in Italy in studying the most illustrious masters and eight in engraving the famous cartoons of Raphael at Hampton Court, for which he received the honor of knighthood from King George I. In 1725 he became a member of the Academy at Paris. One of his best engravings, besides his cartoons, is the 'Transfiguration,' from Raphael, and the 'Apotheosis of Saint Petronilla,' after Guercino. His engraving is easy and strong and the work of the needle and the graver happily united.

DORION, Sir Antoine Aimé, Canadian statesman and jurist: b. Saint Anne de la Perade, P. Q., 17 Jan. 1818; d. 3 May 1891. He was called to the bar in 1842 and became chief justice of the province of Quebec in 1874. He held various cabinet positions, formed with George Brown the short administration of 1858, and was knighted in 1877. He was the leader of the French-Canadian Liberal party of the province of Quebec during the period of the Union.

DORIS, a small mountainous district of ancient Hellas, was the home of the Dorians (q.v.). It is now a part of the modern government of Phocis. Doris was also the name of a district in Asia Minor on the coast of Caria, inhabited by colonists from the Peloponnesus.

DORKING, England, town in Surrey, 22 miles southwest of London, noted for its breed of fowls. It is the scene of the fictitious 'Battle of Dorking.' Its principal trade is in flour, lime and chalk. Pop. about 8,000.

DORKING, a fowl. See POULTRY.

DORMANT STATE. See HIBERNATION.

DORMER WINDOW (Old French *dormeor,* a sleeping-room), a vertical window usually flush with the wall of the house and standing in a projection built out to receive it from a sloping roof. In ordinary house-building it serves as an ornament and at the same time lighting and enlarging an attic chamber. It is very picturesquely used throughout France, Belgium and the Netherlands. In Gothic and Renaissance architecture the dormer window effect was often employed on beautiful stone edifices.

DORMEUR, a fish, one of the triple tails (*Lobolès surinamensis*), found in most warm seas and common in the West Indies. It may reach a length of three feet and is regarded as good food.

DORMITORY (Fr. *dormitoire,* from Lat. *dormire,* "to sleep"), formerly in a monastery or nunnery sleeping quarters either divided into cells or cubicles, opening upon a corridor, or one great apartment divided by partitions or curtains. In connection with American colleges and similar institutions the dormitory is often an entire building divided into bedrooms.

DORMOUSE, the common name given to the family *Myoxidæ,* natives of the Old World. They are pretty little creatures, with soft, fine fur and long squirrel-like tails; but, unlike the squirrels, which they somewhat resemble in habits, they have no cheek-pouches. There are in all four genera of the *Myoxidæ,* containing about a dozen species, the best known of which is the red dormouse, "hazel mouse," or "muscardine" (*Muscardinus avellanarius*), which lives in the woods in most parts of Europe. It is about the size of the common house mouse; has a rather large head, a pointed muzzle, large, prominent eyes and a hairy tail. It is reddish in color above and white below. Its food consists of acorns, nuts (especially hazel nuts) and grain, which it stores for winter use, much as squirrels do. In the coldest weeks of winter it curls up and sleeps, waking, however, at intervals in milder days to feed upon its gathered stores. Its nest is usually made of tangles of herbage, with an opening at the top, and hidden in the underbrush. The fat dormouse (*Myoxis glis*) is larger than the red dormouse, and duller in coloring. It inhabits the forests of southern Europe, where it may be found leaping with remarkable agility from tree to tree. The garden dormouse (*Eliomys nitela*) lives nearer to man, being found in gardens, and often in barns. It destroys fruit growing along walls and trellises. The French call it "lerot"; the Germans "Gartenschläfer."

DORN, Alexander von, Austrian economist: b. Wiener-Neustadt 1838. He was made editor of the *Triester Zeitung* in 1872, and 12 years later founded the *Volkswirtschaftliche Wochenschrift* in Vienna. In 1888 he started a commercial yearbook of the Austro-Hungarian monarchy entitled 'Exportkompass.' He edited *Die Seehäfen des Weltverkehrs* after 1889 and published 'Kreigsmarine und Volkswirtschaft in Oesterreich-Ungarn' (1885), and 'Amerikanisches' (1900).

DORN, Johann Albrecht Bernhard, Russian Orientalist: b. Scheuerfeld, Coburg, 1805; d. 1881. He was educated at Halle and Leipzig and in 1826 became professor of Oriental languages at Kharkov, at the Oriental Institute of Saint Petersburg in 1835, and in 1842 was appointed director of the Asiatic Museum. In 1843 he became chief librarian of the Imperial Public Library. He has specialized on the history and language of Afghanistan and Caucasia. His published works include 'Ueber die Verwandtschaft des persischen, germanischen, und griechisch. lateinischen Sprachstammes' (Hamburg 1827); 'Auszüge aus muhammedamischen

Schriftstellern' (Saint Petersburg 1858); 'Catalogue des manuscrits et xylographes orientaux de la Bibliothèque Impériale' (1852); 'Caspia: Ueber die Einfälle der alten Russen in Tabaristan' (1875); 'A Chrestomathy of the Pushtû, or Afghan Language' (with glossary, 1847); 'History of the Afghans, translated from the Persian of Ni'mat Allah' (2 vols., 1836).

DORNER, August Johannes, German philosopher and theologian, son of I. A. Dorner: b. Schiltbach, Baden, 1846. He received his education at the universities of Berlin, Göttingen and Tübingen. In 1869 he became minister of the German congregations in Lyons and Marseilles. After some years of travel in the Orient he settled down at Tübingen as teacher in 1870, visited America in 1874 and on his return was appointed professor and director of the Wittenberg Theological Seminary. He removed to Königsberg in 1890 and was rector of the university there in 1908–09. He edited his father's 'System der christlichen Sittenlehre' (1885) and his correspondence with Martensen (1888) and wrote 'Augustinus' (1873); 'Kirche und Reich Gottes' (1883); 'Predigten vom Reiche Gottes' (1880); 'Dem Andenken von I. A. Dorner' (1885); 'Das menschliche Erkennen' (1887); 'Das menschliche Handeln, philosophische Ethnik' (1895); 'Grundriss der Dogmengeschichte' (1899); 'Encyklopädie der Theologie' (1901); 'Grundriss der Religionsphilosophie' (1903); 'Heilsglaube und Dogma' (1905); 'Die Entstehung der christlichen Dogmen' (1907); 'Pessimismus, Nietzsche, und Naturalismus' (1911); 'Die Metaphysik des Christentums' (1913) and contributions to theological journals.

DORNER, Isaak August, German Protestant theologian: b. Würtemberg, 20 June 1809; d. Berlin, 8 July 1884. He studied theology and philosophy at Tübingen; and had already filled chairs at Tübingen, Kiel, Königsberg, Bonn and Göttingen, when in 1861 he was called to be professor at Berlin. His greatest work is the 'History of the Development of the Doctrine of the Person of Christ' (1861–63). Among his other works are 'History of Protestant Theology' (1871); 'System of Christian Doctrine' (1880–84); 'Christian Ethics' (1887). Consult Pfleiderer, 'The Development of German Theology Since Kant' (New York 1890).

DORNICK, or **DORNOCK,** a species of coarse, figured linen, named from Tournai or Doornick in Flanders. The manufacture, introduced into England by the Dutch who fled from the persecutions of Alva, was long confined by law to inhabitants of Norwich and Pulham. A similar cloth called dornock was made at Dornock, Scotland.

DORNOCH, dôr'nŏk, **FIRTH,** an arm of the sea, on the east coast of Scotland, separating Sutherlandshire from Ross and Cromarty. The royal burgh of Dornoch is near the entrance. There is a famous old cathedral dating from the early 13th century. Skibo Castle, the residence of Andrew Carnegie, is four miles west of Dornoch. Fishing is valuable but navigation is difficult. Pop. about 750.

DORNOCK. See DORNICK.

DOROHOI, dō-rō-hoi', Rumania, a town in the northwest of Moldavia, near the Austrian frontier. The principal trade is in timber. Pop. 15,000, half being Jews.

DORPAT, dôr'pät, or **DÖRPT** (Russian official name Yuriev, Lettish *Tehrpat*), Russia, city in the government of Livonia, on the Embach, about 135 miles northeast of Riga. Dorpat is chiefly remarkable for its university, which was founded in 1632 by Gustavus Adolphus, when the Swedes were masters; it was suppressed, in 1656, by the Muscovites; and re-established by the Emperor Alexander, in 1802–03. In the northwest section of the city there formerly existed a citadel, an episcopal palace and cathedral. The place of these is today occupied by the observatory, which the labors of Dr. Struve have made famous, a library and several university buildings. Dorpat contains also botanical gardens, several boulevards and promenades, a town-hall, several churches and a monument to its famous son, Barclay de Tolly. A levee system protects the city from the periodical overflow of the Embach. Other educational institutions located here are a veterinary school, a training school for teachers, gymnasia and secondary schools. It has also a large number of industrial establishments and as a commercial centre is second only to Riga in the Livonia region. Dorpat first fell to the Russians in 1559 and in 1582 was taken over by Poland. Later the Swedes held it for a time, and next came the Poles and in 1704 it finally became a part of Russia. Four years after its occupation by the latter they removed the inhabitants to the interior and dismantled the city. While Russian is the official language, German is the common means of intercourse between the inhabitants. Consult Hausmann, 'Aus der Geschichte der Stadt Dorpat' (1872). Pop. 45,000.

DÖRPFELD, derp'felt, **Wilhelm,** German archæologist: b. Barmen 1853. He received his education at the Bauakademie, Berlin. In 1877–81 he was a member of the exploration and excavation party at Olympia and was director of operations there in 1878. In 1887 he received the appointment of secretary to the German Archæological Institute at Athens. He directed excavations in many parts of Greece, particularly in regard to ancient amphitheatres and theatres. With Reisch he wrote 'Das griechische Theater' (Athens 1906). He completed Schliemann's excavations at Troy and collaborated with Curtius and others on 'Ausgrabungen zu Olympia' (1877–81). He assisted Schliemann in preparing 'Troja' (1884) and 'Tiryns' (1886). He contributed numerous articles to archæological journals on professional topics and wrote 'Troja und Ilion' (2 vols., 1902). Consult Goodell (in *American Journal of Philology,* Vol. XVIII, 1897).

DORR, Rheta Childe, American editor: b. Omaha, Neb. For two years she studied at the University of Nebraska and in 1902–06 was editor of the woman's department of the New York *Evening Post.* In 1908–11 she was on the staff of *Hampton's Magazine.* She also made special investigations in factories, mills, stores, etc., to study the conditions of labor there for women and children. She

wrote 'What Eight Million Women Want' (1910) and magazine articles.

DORR, Thomas Wilson, American politician: b. Providence, R. I., 5 Nov. 1805; d. there, 27 Dec. 1854. He was a member of the assembly of Rhode Island in 1833–37, and was the leader of Dorr's Rebellion. See DORR'S REBELLION.

DORR'S REBELLION, 1840–42. Rhode Island after the Revolution continued under her charter of 1663 for nearly three-quarters of a century (see CONSTITUTIONS, STATE), it being already that of a self-governing democracy. But it had two features growingly undemocratic, one of them sure to end in an explosion; the town representation in the legislature was based on 17th century ratios of importance, since then greatly changed — thus Newport with some 8,000 people had six members, Providence with 23,000 had four, Smithfield with 9,500 had two; and the suffrage constituted a propertied minority with primogeniture, being restricted to holders of $134 worth of real estate or $7 annual renters, and their eldest sons. Of 22,000 to 23,000 taxable polls, only 9,590 were freemen; Providence with above 23,000 inhabitants had 1,610 voters, Woonsocket with some 3,000 had 150, etc. Over $1,000,000 of personal property in Providence was unrepresented. That city was naturally the focus of discontent; Newport as naturally the champion of the established order.

From 1834 on, when he was first chosen to the legislature, the discontent was voiced by Thomas Wilson Dorr (q.v.). He formed something like a suffrage party organization; but it dissolved from discouragement in 1838. A convention representing only the landholders meantime threw out with only seven votes a proposition to extend the suffrage and the Whigs smothered the agitation till after Harrison's election in the fall of 1840. Then Dorr, who had joined the Democrats, organized mass-meetings and the suffrage became the burning question of the hour during the winter. As the legal organs of relief were packed against them by the very system against which they protested, the disfranchised had no recourse but revolution. On the claim of "natural right," they held a convention in October 1841, drafted a constitution and called for a popular vote upon it; only their own party voted, but by fictitious lists a vote of some 14,000 was computed, about twice the actual number cast. This being a majority of the legal voters, the suffrage party proclaimed the "People's Constitution" as the lawful régime of the State, 13 Jan.' 1842. Meantime the landholders' party had called a legal convention, which met in November, split into angry factions and adjourned to 14 Feb. 1842. But the proclamation of the revolutionary constitution sobered them down; they drew up one practically as liberal as the other, and for the first time allowed those qualified under it to vote on it. The suffrage party was now offered all it claimed; but it was too much committed to its new principle of mass-rule to recede and the "Landholders' Constitution" was voted down, 8,689 to 8,013. On 13 April the suffragists held an election under the People's Constitution, at which only their own party voted and chose Dorr governor, with a legislature and corps of State officers. Of course all these proceedings were legally null, and the "Law and Order Party" as they called themselves, recognized them only as treasonable attempts to overturn the legal government.

At an extra session in March the legislature had made the taking of office under the Dorr government treason, and acting as moderator or clerk at their elections a serious misdemeanor; a law dubbed by the Dorr party the "Algerine Act." At the regular April elections Samuel W. King was chosen governor; and another extra session empowered him to proclaim martial law and call on the Federal government for the help against domestic insurrection guaranteed by the Constitution. President Tyler replied that help should be furnished when violence had actually supervened, but the government could not interfere on a mere apprehension. On 3 May Dorr and his party marched into Providence, and after debating a forcible occupation of the state-house, began legislative sessions in a disused iron foundry. They sat two days, formally repealed the "Algerine Act," demanded of Governor King the custody of the State property, notified the Federal government of their formation of the legitimate State government, etc., and adjourned to 5 July, but never met again. The regular legislature met at Newport 4 May, and the governor again appealed to the President, receiving the same answer; but the military commanders of the vicinity were ordered to keep in touch with the State authorities. Dorr went to New York and elsewhere for recruits and funds, came back on the 16th and on the night of the 17th–18th undertook to capture the Providence arsenal, but his own men disabled his cannon and his force melted away — his chief adherents by this time being sick of the farce, when the other party were ready to grant all their demands. Dorr escaped into Connecticut (where the governor refused to give him up on requisition) and prowled around the border for several weeks, getting men and stores together — the former mainly young fellows on a "lark"; finally late in June he crossed the border and the President decided that the time had come to order United States troops to interfere. On the 26th a crushing force marched against Dorr at Chepachet, R. I., and his men on that and the next day dispersed without waiting the event. Dorr remained in hiding for some weeks and a reward was offered for him; in October he returned and gave himself up for trial, was convicted of high treason in March 1844, and sentenced to life imprisonment. He was pardoned in 1847 and restored to civil life in 1852. Meantime, in November 1842, a new convention had been held by the regular authorities, adopted by the people November 1842 and became operative in May 1843. The suffrage was practically made universal. The proceedings of the State government were held legal by the United States Supreme Court in Luther *v.* Borden, argued by Webster and decided by Taney. It must be said for Dorr that but for the menace of civil war the suffrage never would have been extended; after the offer of the "Landholders' Constitution," however, he and his party became inexcusable disturbers of public order, risking bloodshed for the question of the legal theory under which the rights already obtained should be held. The great repository of material on this subject is the

'House Report of the 28th Congress' (1st session, No. 546); the best single summary is Francis Bowen's in the *North American Review* (1844).

DORRIT, Amy, the "Little Dorrit" of the novel of the same name, by Charles Dickens.

D'ORSAY, dôr'sā', **Alfred Guillaume Gabriel,** COMTE, French leader of fashion: b. Paris, 4 Sept. 1801; d. there, 4 Aug. 1852. In 1822 he became acquainted with Lord and Lady Blessington and renounced his military career for the pleasure of their society. In 1827 he married Lord Blessington's only daughter by a first marriage, but a separation shortly followed, and Lord Blessington having died in 1829, D'Orsay returned to England with Lady Blessington, where they became the centre of a circle distinguished for art, rank, literature and accomplishments. They returned to Paris in 1849, where D'Orsay occupied himself with portrait painting and the making of busts and became director of fine arts.

DORSE, a small codfish found in the Baltic. Formerly supposed to be a distinct species (*Gadus callarias*), but now believed to be the young of the common codfish.

DORSETSHIRE, a maritime county in the south of England, between Devonshire and Hampshire on the English Channel; area, 987.9 square miles. Portland stone is quarried in this county. Other industries are agriculture and stock-raising. There are interesting ancient ruins dating from prehistoric times. The surface is irregular and there are many high ranges. Picturesque watering places make the county famed as a summer resort. Among these places may be mentioned Lyme Regis, Charmouth, Bridport, Weymouth and Swanage. The Stour, Cale, Lidden, Frome, Yeo and Char rivers traverse the county. The capital is Dorchester. Pop. (of county) about 225,000.

DORSEY, George Amos, American anthropologist: b. Hebron, Ohio, 6 Feb. 1868. He was graduated at Denison University in 1888 and at Harvard in 1890. He traveled and conducted anthropological investigations in South America for the Chicago Exposition, 1891–92, and was superintendent of archæology in the department of anthropology at the Exposition in 1893. In 1894–95 he was assistant in anthropology and in 1895–96 instructor at Harvard University. He was assistant curator of anthropology in 1896–98 and curator in 1898–1915 at the Field Museum of Natural History, Chicago. From 1898 to 1913 he served also as professor of comparative anatomy at the Northwestern Dental School. In 1905–08 he was assistant professor of anthropology, and since 1908 associate professor at the University of Chicago. In 1914–15 he made motion pictures in Japan, China and India. In 1909–12 he was on the staff of the Chicago *Tribune,* investigating sources of emigration in Italy, Austria, Rumania, Serbia, Bulgaria and studying political conditions in India, China, Japan, Australia and South Africa.

DORSEY, Sarah Anne Ellis, American author: b. Natchez, Miss., 16 Feb. 1829; d. New Orleans, La., 4 July 1879. She received a careful education and enjoyed the advantages of extended foreign travel. In 1853 she married Samuel W. Dorsey of Maryland. She began her literary career by writing for the New York *Churchman,* receiving from that journal the *nom-de-plume* of "Filia Ecclesiæ." In 1860 she sent to New York for publication the choral services that she had arranged and used successfully among her black pupils for years, but the war suspended the publication. Her family suffered severely in the Civil War. She removed to Texas with her slaves and there served as nurse in a Confederate hospital. After her husband's death in 1875, she removed from her plantation in Tensas parish to Beauvoir, on the Gulf shore. Here she continued her literary labors, acting as amanuensis to Jefferson Davis in the preparation of his 'Rise and Fall of the Confederate Government.' She afterward removed to New Orleans. Her published works are 'Recollections of Henry Watkins Allen, ex-Governor of Louisiana' (New York 1866); 'Lucia Dare' (1867); 'Agnes Graham' (1869); 'Atalie or a Southern Villeggiatura' (1871); 'Panola: A Tale of Louisiana' (1877).

DORSEY, Stephen Wallace, American politician: b. Benson, Vt., 28 Feb. 1842; d. Los Angeles, Cal., 20 March 1916. He served in the Federal army during the Civil War and subsequently removing to Arkansas was active in politics. He was a member of the Republican State and county committees; was elected to the United States Senate in 1873; and was secretary of the Republican national committee for the campaign of 1880. At the time of the "star route" exposures he was accused of having influenced legislation in the Senate, was indicted before the grand jury in Washington; but was acquitted on his second trial. After 1880 he withdrew from politics.

DORSTENIA (named after Dr. Dorsten, a German botanist), a genus of plants of the family *Moraceæ,* natives of tropical America. The genus is remarkable for the receptacle in which the numerous small flowers are sunken, the female flowers being the most depressed. The rootstocks of various species are used in the preparation of a medicine, once in much repute against low fevers and as a mild stimulant and diaphoretic, also as efficacious against snake bites, whence the Spanish name, *contrayerba.*

DORT, dôrt, or **DORDRECHT,** dôr'drĕHt, Holland, city in the province of South Holland, on the Meuse delta, 10 miles southeast of Rotterdam. An inundation in 1421 in which upward of 70 villages were destroyed and 100,000 people drowned, separated the site on which Dort stands from the mainland. It was founded in 1013. It was an important commercial centre in the Middle Ages and a member of the Hanseatic League. Here, in 1572, the states of Holland, after the revolt from Spain, held their first assembly; and sat from 13 Nov. 1618 to 19 May 1619, the conclave of Protestant divines known as the Synod of Dort (q.v.). Dort is the birthplace of the brothers De Witt of Cuyp, and Ary Scheffer; to the last a statue was erected in the market-place in 1862. There is a fine old Gothic church with a tall tower. The principal industries are oil, grist and saw manufactures, foundries and cordage-works. Pop. about 40,000.

DORT, Synod of, an assembly of Protestant divines convoked at Dort (Dordrecht)

in 1618–19. Besides the Dutch and Walloon divines, it included representatives from England, Scotland, Switzerland and part of Germany. There were 84 clerical and 18 secular representatives. It was chiefly occupied in considering the doctrines of Arminius (see ARMINIANISM). It affirmed the five points of Calvinism: (1) Predestination; (2) Death of Christ; (3) Corruption of Man; (4) Divine Grace; (5) Perseverance of the Saints. It originated the project of translating the Bible into Dutch, which was executed after 19 years' labor. The translation is known as the 'Dort Bible.' As a result of the Synod, Barneveldt, the leader of the Arminians, was executed. Consult Schaff, 'Creeds of Christendom' (Vols. I and III, New York 1884).

DORTMUND, dōrt'moont, Germany, city in the province of Westphalia, on the Ems, 73 miles north-northeast of Cologne. In 1899 it was connected by canal with the canalized Ems (giving a waterway to Emden on the North Sea) and extensive harbor accommodation has been provided. It owes its recent great and increasing prosperity to its becoming the centre of several important railway systems, to the opening of extensive coal mines in the vicinity and to the active manufactures of iron, steel, machinery, railway plant, etc. It was once a free imperial and Hanseatic town, and the seat of the chief tribunal of the Vehme. The city was once fortified by a great wall, which gave way in the last century to fine promenades. It contains several splendid churches, gymnasia, industrial schools, a municipal theatre and several primary schools. Dortmund began to decline after the Thirty Years' War, but within the last 50 years, especially since the war with France, it has again advanced rapidly. Consult Sievers, 'Uebersichtkarte de Berg und Hüttenwerke im Oberbergamtsbezirk Dortmund' (Leipzig 1890); Shadwell, A., 'Industrial Efficiency' (London 1906).

DORY, or JOHN DORY (*Zeus faber*), a fish belonging to the family *Zenidæ*, somewhat allied to the mackerel, and celebrated for the delicacy of its flesh. It has the spinous portions of the dorsal and anal fins separated by a deep emargination from the soft-rayed portion, and has also the base of all the vertical fins, and the carina of the belly anterior to the anal fin, furnished with spines or serratures; color, yellowish-green, with a blackish spot on each side; dorsal and anal fins with furcate spines and a long filament produced from behind each dorsal spinous ray. The dory has exceedingly protractile jaws, which enable it to capture small fish, etc., when concealed in the ooze or weeds, after slowly moving upon them in a stealthy, catlike manner. It is found on the coast of England, and on the Atlantic shores of Europe, and in the Mediterranean. A related species (*Zenopsis ocellatus*) has been once taken on our coasts at Provincetown, Mass. Also a North Atlantic species of rock-fish (q.v.)

DOS PASSOS, John Randolph, American lawyer: b. Philadelphia 1844. He is of Portuguese descent. He studied law; served in the Federal army during the Civil War, and after practising law in Philadelphia for some time went to New York in 1867, where he was very successful in the criminal branch of practice. Later he became an authority upon banking, corporate and financial law. He has written considerably. Among his published works are 'A Treatise on the Law of Stock Brokers and Stock Exchanges' (1882; 2d ed., 1905); 'The Interstate Commerce Act' (1887); 'Commercial Trusts' (1901); 'The Anglo-Saxon Century' (1903); 'The American Lawyer' (1908), and various pamphlets on political economy and financial topics.

DÔSEH, dō'sĕ, an Arabic word meaning "treating," denotes a remarkable ceremony, which, until its suppression in 1884, used to take place in Cairo annually on the feast of the Prophet's birth (Moolid), in the third month of the Mohammedan year. A party of dervishes of the Sa'di order, to the number of a hundred or more, lay down on their faces, side by side, with their arms doubled under their foreheads. A dozen more ran along upon their comrades' prostrate backs, beating drums, and shouting "Allah." Then the sheikh, mounted, rode along upon the line of bodies, from whom audible prayers could be heard proceeding. It was in consequence of evidences of considerable injury inflicted by the iron-shod hoofs that the Khedive Tewfik suppressed this singular religious rite. Consult Lane, E. W., 'Modern Egyptians,' xxiv; Butler, 'Court Life in Egypt.'

DOSITHEANS (from their founder, Dositheus), a sect founded by Dositheus, a Jewish heresiarch of the 1st century A.D., whose life and labors were in Samaria. The popular belief is that he was the first Christian "heretic." Mosheim, on the contrary, thought that he was not a Christian at all, but a false Messiah, who lived at or about the time of our Lord. He is said to have been very rigid in his Sabbatarianism, and to have died of excessive fasting. His other opinions were partly Samaritan, partly Sadducean.

DOSITHEUS, a grammarian who lived in the 4th century, and wrote a Latin grammar for Greek boys. See also DOSITHEANS. Consult Keil, 'Grammatici Latini' (Vol. VII, Leipzig 1871).

DOSSO DOSSI, dōs'sō dōs'sē (properly GIOVANNI DI NICOLO LUTERO), Italian painter: b. near Mantua 1470; d. Ferrara 1542. He was one of the leaders of the Lombardo-Ferrarese school and studied under Lorenzo Costa or Panetti (a disputed point). His brother, Giovanni Battista (d. 1546) was less distinguished as a painter. He assisted in executing many of the larger paintings. The brothers are said to have spent six years at Rome and five at Venice. Under the patronage of the Gonzagas at Modena, and later of the dukes of Ferrara, they executed many decorative paintings for palaces and churches and likewise numerous minor works of art. 'Saint Bartholomew and Saint John at Patmos' (1527) at the cathedral of Ferrara is ascribed to Dosso Dossi. Together they painted the 'Labours of Hercules' in the Cortile of the Ducal Palace of Ferrara, a 'Madonna with Saints' (1522) at the cathedral at Modena, and frescoes in the Castle of Trent, since destroyed. They are mentioned by Ariosto in 'Orlando Furioso' (XXXIII, 2) with the highest praise. In manner Dosso Dossi

resembles Titian. His pictures are distinguished by their bright coloring and imaginativeness. Other paintings are 'The Bacchanal' in the Palazzo Pitti, Florence, and at the Dresden Museum; 'Justice'; 'Diana and Endymion'; 'One of the Hours'; 'Peace'; 'A Dream'; 'Judith,' and 'The Dispute of the Four Doctors of the Church,' which is generally considered his masterpiece. His 'Circe' was painted for the Palazzo Borghese, Rome, and his 'Saint Sebastian' for the Brera at Milan. The brothers excelled in landscape painting, and are said to have introduced the painting of independent scenes. Consult Zwanziger, 'Dosso Dossi' (Leipzig 1911).

DOST MOHAMMED KHAN, dŏst mō-hăm-mĕd kän, founder of the dynasty of the Barakzai in Afghanistan: b. 1793; d. 1863. His brother Fatteh Khan was instrumental in securing the throne for Mahmud, who later, envious of his power, had him assassinated. The family of Fatteh Khan proceeded to avenge his death by dethroning Mahmud and dividing the territory among themselves. Ghanzi was given to Dost Mohammed, who by conquest gained control of the entire province. Numerous disputes followed with Ranjit Singh, the Sikh prince of Punjab, which finally resulted in the defeat of the latter, who, however, seized the fortress at Peshawar. The amir desiring to regain this now appealed to England, but his advances were rejected and he turned to Russia. Troops were sent against him in 1838 under Sir Willoughby Cotton, and the troops of Dost Mohammed were defeated, while he himself was captured 1840. After the assassination of his rival Shah Sujah whom the English desired to restore and the subsequent resolve of the British to withdraw from their intervention in international affairs in Afghanistan, Dost Mohammed was re-established at Kabul and set up a strong government. His last participation in hostility to the British was in the Sikh war against them. He finally concluded a treaty with the Anglo-Indian government in 1855. The rest of his reign was occupied with resistance to the encroachments of the Persians and the capture of Herat. He was succeeded by his son Shere Ali Khan.

DOSTOYEVSKY, dŏs-tō-yĕf'skĭ, **Feodor Mikhailovitch,** Russian novelist: b. Moscow, 11 Nov. 1821; d. Saint Petersburg, 9 Feb. 1881. He was educated at Moscow and at the Military Engineering Academy of Saint Petersburg. He was graduated there in 1843, with the grade of sub-lieutenant. On his father's death in 1814, he resigned to devote himself to literature, and began a long struggle with ill-health and poverty. He made his literary début with 'Poor People' in 1846, in which may be discovered the germ of all his imaginative work. Dostoyevsky now became a regular contributor of short stories to the *Annals of the Country,* but he was wretchedly paid and his work, while revealing extraordinary power and intensity, is wanting in finish and proportion. In 1847 he became a member of the revolutionary reunions of the agitators, Petrachevski, and for his connection was condemned to death in 1849. On the scaffold the novelist's sentence was commuted to four years' exile in Siberia, and enforced military service in the ranks for life. He was transported to Omsk, Siberia, and spent four terrible years there. He has left a graphic narrative of his experiences in 'The House of the Dead' (1858). He was subjected to fresh indignities as a common soldier after his release from Siberia, but in 1858, through the intercession of General Todleben, an old schoolfellow, he was made an under-officer, and in 1859 was pardoned by Alexander II. His association with the worst criminals gave him an insight into the dark and seamy side of Russian life. He formed new conceptions of human life and character and gave expression to his new views in 'Crime and Punishment' (1866). It showed the author to be possessed of a rare mastery over the emotions of terror and pity. This work was his greatest, for while his later works showed great tragic and analytic power, they are deficient in measure and proportion. The chief of them are 'The Insulted and Injured' (1867); 'The Idiot' (1869); 'A Raw Youth' (1875); 'The Brothers Karamazov' (1881). After 1865 he became an ardent Slavophile and mystic, with a tendency to absolutism. He was engaged in a succession of journalistic enterprises and suffered severe pecuniary losses. For a time he was editor of the *Russian World,* and after 1876 published a review, the *Carnet d'un écrivain.* Toward the end of his life he became very popular and his latest years were spent in comparative prosperity at Saint Petersburg. The last edition of his works, in six volumes, was issued at Saint Petersburg in 1904. English translations of the following works have been issued: 'The Brothers Karamazov' (New York 1910); 'Crime and Punishment' (ib. 1911); 'The Idiot' (ib. 1912); 'The Possessed' (ib. 1913); 'House of the Dead' (ib. 1914); 'The Insulted and Injured' (ib. 1915); 'A Raw Youth' (ib. 1915); 'The Eternal Husband' (ib. 1917); 'Poor Folk' (London 1884); 'Letters from the Underworld and Other Tales' (New York and London 1914). (See CRIME AND PUNISHMENT). Consult Brande, G., 'Dostojewsky' (Berlin 1889); Hoffman, 'F. M. Dostojewsky' (ib. 1899); Koni, 'Dostoievsky criminaliste,' in *Revue Internationale de Sociologie* (Paris 1898); Lloyd, 'A Great Russian Realist' (New York 1912); Merezhkovsky, "Tolstoi and Dostoyevski," in 'Tolstoi, as Man and Artist' (ib. 1902); Phelps, W. L., "Dostoyevsky," in 'Essays on the Russian Novelists' (ib. 1912).

DOTEN, Carroll Warren, American statistician; b. Panton, Vt., 27 Jan. 1871. He was graduated at the University of Vermont in 1895, was successively instructor, secretary and register there until 1903, when he became instructor in economics at the Massachusetts Institute of Technology. In 1905 he became assistant professor and in 1914 associate professor there. He also directed the research work of the Boston School for Social Workers, 1907–09; was special agent for the United States Census Bureau in 1909. In 1910–12 he was chief investigator of the Massachusetts Commission on Compensation for Industrial Accidents. He has published statistical papers, monographs, addresses and reports, including 'Recent Railway Accidents in the United States.'

DOTHAN, dō'thăn, Ala., city and county-seat of Houston County, 120 miles southeast of

Montgomery, on the Atlantic Coast Line, the Central of Georgia and other railroads. It is an important trading centre and contains sash and door factories, lumber, ice, cotton, cotton-seed-oil mills and fertilizer factories. It is well built and has fine public buildings. The water-works and electric-lighting plant are the property of the municipality. Dothan was first settled in 1885 and is governed, under a charter of 1901, by a mayor and council of nine. Pop. 7,016.

DOTHEBOYS HALL, the school which figures in Dickens' novel, 'Nicholas Nickleby.' It was kept by Squeers. The name is a rendering of Do-the-Boys Hall. The effect of the exposure by Dickens of the conditions prevailing in some of the English boys' schools was a complete reformation in their methods and management.

DOTTEREL (*Charadrius-* or *Eudromias-morinellus*), a species of plover (q.v.) which breeds in the north of Europe and returns to the south for the winter. It is found all over Europe and northern Asia. The dotterel has always been highly esteemed for the table, but its extermination in Great Britain is more likely to result from the assiduity of the egg collector than of the sportsman, a consummation likely to be hastened from its habit of laying but three eggs instead of four like most plovers. It likewise differs from all other species of plover in having the sternum fenestrated instead of notched posteriorly, and in the larger size and brighter colors of the female.

DOTY, Alvah Hunt, American physician: b. Albany, N. Y., 27 July 1854. He was graduated at Bellevue Hospital Medical College in 1878. Until 1911 he was health officer of the port of New York and lecturer on quarantine sanitation at Bellevue Hospital Medical College. In 1913 he became medical director for the Employees' Benefit Fund Committee of the American Telephone and Telegraph Company, the Western Electric Company and the Western Union Telegraph Company. He wrote 'Prevention of Infectious Diseases' (1911); 'The Mosquito: Its Relation to Disease and Its Extermination' (1912); 'Manual of Instruction in the Principles of Prompt Aid to the Injured' (1889; 6th ed., 1913).

DOU, Gerard. See Dow, Gerard.

DOUAI. See Douay.

DOUARNENEZ, doo-är-nē-nēs or -nēz, France, a port in the department of Finistère, on the Bay of Douarnenez, eight miles northwest of Quimper by rail. It is important for the sardine fishery, rope and net making and shipbuilding. Pop. 13,750.

DOUAY, doo'ā', **Felix Charles,** French general: b. 1816; d. 1879. He served in the Crimea, in Italy and in Mexico. For distinguished services at Magenta and Solferino he was made a brigadier-general. He was commander of the Seventh Army Corps in the Franco-Prussian War of 1870 and was made prisoner at Sedan. He was the first to enter Paris on 22 May 1871 as commander of the Fourth Army Corps, organized against the Commune. His timely arrival saved the Louvre from utter destruction.

DOUAY, or **DOUAI,** France, city in the department of Nord, on the Scarpe River, 20 miles south of Lille. It is one of the oldest towns in France. Its manufactures and trade are quite important. It is noted for the schools which were established here in the 16th and 17th centuries. In 1562 Philip II of Spain established a university. English, Scottish and Irish colleges and novitiates of English Franciscans and Benedictines were all affiliated with this university. Printing presses and libraries furnished the books for English Catholics. The university property was confiscated in 1793, during the revolutionary period; students and teachers fled to England, and to this migration the Roman Catholic college at Ushaw, near Durham, owes its origin. The English Benedictines still have an establishment at Douay. The library now in the town contains about 96,000 volumes and many valuable manuscripts. Pop. 36,314. See Douay Bible.

DOUAY BIBLE, the name commonly given to the version of the Vulgate text of the Scriptures made at Rheims in France, for the use of English-speaking Catholics. The translators and editors of this version were Dr. William (afterward Cardinal) Allen, Dr. Gregory Martin, Dr. Richard Bristow and John Reynolds, all of them alumni of Oxford University. The work of translating was done mostly by Dr. Gregory Martin, "a scholar of distinguished attainments both in Greek and Hebrew," says the eminent biblical critic, Dr. Westcott. The New Testament was published at Rheims in 1582 and the Old at Douay in 1609–10, both in quarto. The text has since that time undergone numerous revisions, chiefly for correction of its literary form which was faulty because of the employment of words of Latin origin and unintelligible for readers unacquainted with Latin, instead of the homely English equivalents, for example, "comessations" (revelings), ebriety, impudicity, agnition, coinquination, contristate, donary, exinanite, suasible: all mere Latin words with English terminations. This very serious fault was in revision after revision corrected with greatest thoroughness by Dr. Challoner (q.v.), whose first edition of the revised New Testament was published in 1749 and that of the Old Testament in the following year. Challoner's final revision has itself undergone revision several times since, but only for correction of minor errors and oversights. Despite its very serious defects the original Rhemish translation has elicited from a most competent judge, Dr. Westcott, 'History of the English Bible,' the praise of great fidelity to the text of the Vulgate. "The Rhemists," he says, "in their scrupulous and even servile adherence to the text of the Vulgate . . . frequently reproduced with force the original order of the Greek, which is preserved in the Latin; and even while many unpleasant roughnesses occur there can be little doubt that this version gained on the whole by the faithfulness with which they endeavored to keep the original form of the sacred writings. . . . The same spirit of anxious fidelity to the letter of their text often led the Rhemists to keep the phrase of the original when others had abandoned it. . . . When the Latin was capable of guiding them the Rhemists seem to have followed out their principles honestly; but whenever it was inadequate or ambiguous,

they had the niceties of Greek at their command.»

DOUBLE BASS or BASE, sometimes called contrabass, is the largest and deepest voiced of the violin family. Though seldom used in solo work it is counted one of the foundations of the modern orchestra. Originally it had only three strings, but used to-day with four, from the pitch of the third E below the violin clef. The strings are tuned a fourth apart. It probably derives its name from the fact that it sometimes doubles the bass given to the 'cello or similar instrument in a score. It first appeared in the 16th century and has been attributed to the inventive genius of Gasparo da Salo.

DOUBLE BASSOON, also known as contrafagotto, stands in the same relation to the oboe family as the double bass (q.v.) does to the stringed instruments, being the largest and deepest toned. It has a compass of more than three octaves upward from the third C (and even) below middle C; an octave lower than the ordinary bassoon. It has a conical tube over 16 feet in length, but bent up so compactly that it causes no inconvenience to the player. Many great masters of orchestration have written liberally for it, especially Haydn, Beethoven, Spohr and Mendelssohn.

DOUBLE CITIZENSHIP, a term signifying both State and national citizenship as defined by the 14th Amendment to the Federal Constitution, which states: «All persons born or naturalized in the United States and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside.» A court ruling says that «there is a citizenship of the United States and a citizenship of a State, which are distinct from each other and which depend upon different characteristics and circumstances in the individual» Citizenship in the State cannot be given to an alien; but a naturalized citizen becomes a citizen of the State wherein he resides. The Federal government alone has the right to naturalize; but the State can grant extensive privileges of State citizenship, even the suffrage, to foreigners not fully naturalized. See CITIZENSHIP IN THE UNITED STATES; NATURALIZATION; NATURALIZATION LAWS.

DOUBLE CONSCIOUSNESS, a peculiar mental condition, illustrated and much overdrawn by the celebrated story of Dr. Jekyl and Mr. Hyde, which describes a type of phenomenon practically never met with in real life, although much utilized by the novelist, dramatist and careless observer. By double consciousness is usually meant that at certain times, in the waking consciousness of the individual, certain dominant ideas control and impart to the individual a definite personality, known and recognized as such by his friends and associates, and that, at other times, also in a distinctly conscious state, an entirely different series of ideas may govern the person, making him think, feel and act in a manner entirely different from that of his former personality. No such phenomenon is really known except in conscious acting, where good actors or actresses can portray many personalities. What really happens in the bona-fide situation is a dissociation of consciousness. The so-called double state, which may be multiple, is a split or part of the unconscious state of the individual.

The best examples of this dissociation states are seen in alcoholism, where the partly intoxicated person becomes quite a different type of individual. His unconscious trends are released from a type of conscious control and come out into action. In hysteria similar dissociations are frequent. The so-called classical types of multiple personality, which have been much written about, are various mixed mental states of hysterical dissociation and shrewd duplicity. The physician is often made the dupe of a clever person. Most shrewd women have this capacity to mingle unconscious hysterical fantasy with conscious reality. The unconscious hysterical part of the phenomenon is bona-fide and not consciously known or controllable. This must be emphatically emphasized. In certain epileptics, an automatic mental state may arise in which the individual may carry on complex motor and intellectual activities, apparently normal and conscious — to the lay observer — and yet these are dissociated mental states absolutely unknown to the waking healthy conscious state of the individual in question. During such automatic unconscious states crimes may be committed — such as larceny, murder and yet the patient is not cognizant of the act and is irresponsible. These dissociated mental states are frequent in dementia præcox and at times in anxiety hysterias and compulsion neurosis.

The usual hypnotic seances, in which such dissociated states are demonstrated, are largely fraudulent. When bona-fide they are usually examples of hysterical dissociation which is an extremely interesting and widespread mental state. Nearly all individuals are partly capable of a certain amount of hysterical dissociation. Excessive anger and weeping are widespread illustrations of these partly dissociated states.

Consult Janet 'Mental State of Hystericals'; Freud, 'Hysteria and the Psychoneuroses'; Jelliffe and White, 'Diseases of the Nervous System.'

DOUBLE DRAGON, Order of the, a military order of China, established to honor foreigners who had served China in a military capacity. In 1882 it was made to include other foreigners who had rendered service to the nation.

DOUBLE EAGLE, a United States coin of the value of $20, the eagle being $10. The name is a book-word, the popular term being «twenty-dollar gold piece.» The piece was authorized by Congress in March 1849, and the first ones were struck in 1850. The name refers to the figure of the eagle upon it. It was one of the coins authorized by the Act of 1873.

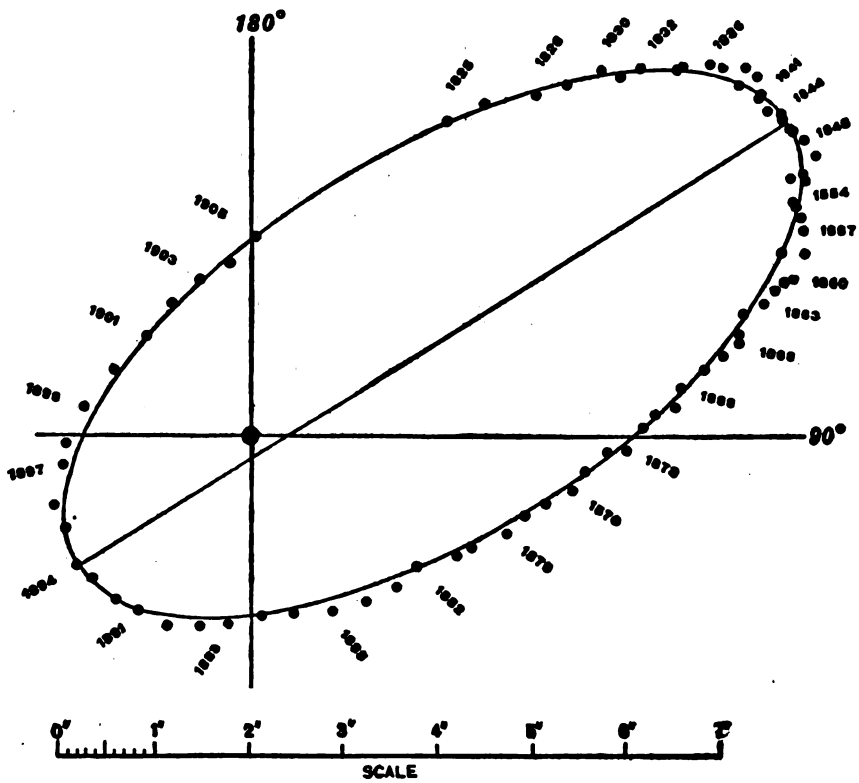
DOUBLE FLOWERS are flowers which, usually through cultivation, have their stamens and pistils developed into petals, by which the beauty of the flower may be enhanced, though its reproductive powers are sacrificed. All intermediate stages between stamens and petals can be seen in double-flowered roses and carnations. It is frequently observed that a multiplication of the leaf accompanies the conversion of stamens into petals; so that a single stamen may be represented by two or more petal-like leaves. Double flowers remain fresh

two, three even eight days longer than similar normal single flowers.

DOUBLE MAJORITY. In Canada under the Union there sprang up a demand — urged by each of the political parties while in opposition but not regarded as practicable when they held the reins of government — that an administration to hold office should possess a majority in both Lower and Upper Canada. Owing to the sharp divergence in race, religion and political ideals between the two provinces, this was unrealizable. The "double majority" was never accepted either as a principle or a convention of the constitution; it received no sanction from the governors; and was finally disavowed at Confederation.

DOUBLE STANDARD, in economics the phrase used to signify a double standard of monetary value fixed by legislative enactment. It implies the existence of what is known as the gold standard on the one hand, and the silver standard on the other. Wherever the double standard in its integrity is in use a creditor is bound to accept payment of any sum in coins of either of the metals, gold or silver, which the debtor may choose to tender. See BIMETALLISM.

DOUBLE STARS are stars which, while they may appear single to the eye, are known, by telescopic observation, to consist of two constituents that are near enough together to justify the assumption of a physical connection.



70 Ophiuchi Σ 2272

DOUBLE SHUFFLE. An expedient by which John A. Macdonald and his colleagues of the Canadian Macdonald-Cartier administration, when they succeeded the short-lived Brown-Dorion ministry in 1858, evaded the necessity of vacating their seats and going before their constituencies for re-election. The Brown-Dorion ministry had only lasted three days; and the statute governing the case stated that if a minister should resign and within one month accept another office in the ministry, he should not vacate his seat. Accordingly Macdonald and his colleagues changed portfolios, took the oath in their new offices, and immediately thereafter resumed their former places in the ministry.

In many such cases it is afterward found, however, that the two stars are not members of one system but that one of them is vastly farther away from us than the other, their seeming close proximity being only apparent and not real. Such pairs are called "optical" pairs. As it is not until measures have been accumulated for at least several years that a distinction can be made in any case between an optical pair and a true binary system, all discoveries are tentatively catalogued as double stars. About 20,000 such pairs are now known. The first systematic study of these objects was made by Sir William Herschel, who, between the years 1779 and 1784, made extensive catalogues of them, because he thought it likely that they

were only optically double. If that were the case, the earth's orbital motion about the sun might be great enough to make an appreciable variation in the distance or direction of one star from the other, if the system were viewed at different times in the year. After recording the distances between many of these stars, as well as the direction of the line joining the two components, he went over them again to see if any changes could be noted; and in so doing (as his son, Sir John Herschel, has recorded) "his attention was altogether diverted from the original object of the inquiry by phenomena of a very unexpected character, which at once engrossed his whole attention." Instead of finding an annual and alternate increase and decrease of the distance, and a corresponding periodic variation in their direction, he saw that in many cases there was a continuous change in both, advancing steadily in one direction. If this were due to the fact that the solar system and the two components of the double star were moving independently through space, we should expect the motion of either of the components, relatively to the other one, to be sensibly rectilinear. After the lapse of 25 years Herschel became satisfied that this is not always the case, for in some instances he found good evidence of actual orbital motion, and in 1802 he announced that "there exist sidereal systems, composed of two stars revolving about each other in regular orbits," in the same manner that the earth revolves about the sun, or the moon about the earth. About the year 1819 William Struve took up the systematic study of these stellar systems, and made a long series of most excellent measures of them covering a period of many years. Subsequently the work was taken up by other skilled observers, and we now have a vast mass of data of this sort, from which fairly good orbits of some 60 of the systems have been obtained. A beginner's book on the subject is Crossley, Gledhill and Wilson's 'Handbook of Double Stars,' which contains methods for computing the orbits of double stars, as well as advice concerning the making of observations. The standard and authoritative work is S. W. Burnham's 'General Catalogue of Double Stars,' which contains the description of every pair discovered, and references to all measures ever published, and to all proper motions and orbits computed, up to the year 1906. In reality, both of the components of a double star are in motion, each revolving about the common centre of gravity of the two; but it is known that in a system composed of two bodies revolving about each other no error is committed, so far as the relative motion of the two is concerned, by regarding one of them as fixed, and assuming that the other revolves about it. It is customary, therefore, to regard the brighter component of such a star as fixed. The diagram shows the orbit of the pair known as F. 70 Ophiuchi, in which one star is of about the fourth magnitude, while the other is of about the sixth. The large black spot at the intersection of the two straight lines represents the larger star, the straight lines themselves representing, respectively, an hour circle and a declination-circle passing through it. The ellipse represents the apparent orbit of the component star, as determined by Burnham from all the available data up to the year 1905. The dots that appear irregularly along the ellipse, being sometimes within it and sometimes without, represent the observed positions of the companion star. According to the computations here cited, the period of revolution of 70 Ophiuchi is 87.75 years. In addition to the stars that are visibly double when viewed through the telescope, numerous stars are now known which have been proved to be double by means of spectroscopic observations. (See DOPPLER'S PRINCIPLE). The periods of revolution of some of these are exceedingly short. Thus, one of the components of the telescopically double star Kappa Pegasi is itself a spectroscopic binary with a period of only six days. At least one of the spectroscopic double stars (Epsilon Hydræ), is also a visual double in the telescope; the orbit computed from the direct measures agrees remarkably well with that found from the spectroscopic observations, thus affording a proof (if one were needed), that the displacement of the spectral lines in these cases is due to a true duplicity and is not the effect of some other, unknown, cause.

DOUBLEDAY, Abner, American soldier: b. Ballston Spa, N. Y., 26 June 1819; d. Mendham, N. J., 26 Jan. 1893. In 1839 at Cooperstown, N. Y., he aided in drawing up the first baseball rules in the United States. He was graduated at the West Point Military Academy in 1842 and was assigned as brevet second lieutenant of artillery the same year. During the Mexican War he served in the First Artillery and was present at the battles of Monterey and Buena Vista. He was also engaged in suppressing the uprising of the Seminole Indians. He participated in the memorable defense of Fort Sumter, firing the first gun in reply to the enemy's attack. From the Shenandoah Valley to the Rappahannock, at Manassas, South Mountain, Antietam, Fredericksburg and Chancellorsville, he added lustre to his name and justly earned the command of an army corps with the rank of major-general. At Gettysburg General Doubleday found a fitting climax to his active military career. The acknowledged hero of the first day's fight, he contributed as much toward the final result achieved as any other commander in the entire engagement. He continued to serve in the regular army after the war, but retired in 1873. A bronze statue of the general was unveiled on the Gettysburg battlefield 25 Sept. 1917. He published 'Reminiscences of Forts Sumter and Moultrie in 1860–61' (1876), and 'Chancellorsville and Gettysburg' (1882).

DOUBLEDAY, Frank Nelson, American publisher: b. Brooklyn, N. Y., 8 Jan. 1862. He was educated at the Brooklyn Polytechnic Institute; entered the employ of Charles Scribner's Sons, publishers, in 1877 and remained with that house until 1895; during that time he refounded and edited *The Book Buyer* (1884), and was appointed manager of *Scribner's Magazine* in 1886. From 1897 to 1900 he was a member of the publishing firm of Doubleday and McClure Company. Since 1900 he has been president of Doubleday, Page & Co., publishers of *The World's Work, Country Life in America, The Garden Magazine* and *Farming*.

DOUBLEDAY, Neltje De Graff ("Neltje Blanchan"), American author: b. Chicago, 23 Oct. 1865. She was married to F. N. Doubleday

in 1886. She has published 'The Piegan Indians' (1894); 'Bird Neighbors' (1897); 'Birds that Hunt and are Hunted' (1898); 'Nature's Garden: Our Wild Flowers and Their Insect Visitors' (1900); 'Birds Every Child Should Know' (1907); 'The American Flower Garden' (1909); also pamphlets, magazine articles, essays, etc., on education, North American Indians, nature study, etc.

DOUBLEDAY, Russell, American author: b. Brooklyn, 26 May 1872. He was educated in private schools and served in the United States navy during the Spanish-American War 1898. He has written 'A Gunner Aboard the Yankee' (1898); 'Cattle Ranch to College' (1899); 'A Year in a Yawl' (1901); 'Stories of Inventors' (1904).

DOUBLET, a close-fitting garment, covering the body from the neck to a little below the waist. It received its name from being originally lined or wadded for protection. At first it had short shirts, but these diminished as the body of the garment became fuller and more elaborate under the reign of Queen Elizabeth. During the period of Charles I and after Charles II it lost all pretense and dwindled into a sleeveless jacket, the forerunner of our modern waistcoat. Originally it was introduced from France into England in the 14th century.

In lapidary work, a counterfeit stone composed of two pieces of crystal, with a color between them, so that they have the same appearance as if the whole substance of the crystal were colored. It is accomplished another way by taking a thin layer of a precious gem and fastening it on the line of the girdle to a piece of glass colored to match. Some invisible cement is employed for the purpose, such as gum mastic.

DOUBLING THE CUBE. See QUADRATURE OF THE CIRCLE.

DOUBLOON, dŭb-loon', a gold coin of Spain, equal in value to two pistoles. It was worth 1730 to 1772 about $8.24, from 1772 to 1786, $8.08, and from 1786 to 1848, $7.87. Although the coinage of the doubloon has ceased in Spain, coins still current are valued at $5.02.

DOUBS, doo, France, . (1) department which is traversed by four chains of the Jura. Area, 2,030 square miles. Pop. 299,935. Doubs is traversed by the river Doubs, a tributary of the Saône, the Dessoubre and the Loue. The climate is more rigorous than in most similar latitudes of Europe. Pine, walnut and common orchard trees thrive well; mines of iron and coal are worked; and gypsum, building stone, lime and marble are abundant. The trade is principally in iron, cattle, horses and dairy products. It is famous for its cheese. The department was formed out of part of the old Franche-Comté. The capital is Besançon. (2) Doubs, a river 250 miles in length, rises in this department.

DOUBTING CASTLE, the castle in 'Pilgrim's Progress,' where Christian and his companion, Hopeful, are imprisoned for a time by Giant Despair.

DOUC, dook, a species of small monkey (*Semnopithecus nemæus*), native to Cochin-China. It is curiously marked with red, white and black.

DOUCET, doo'sā', **Charles Camille,** French dramatist: b. Paris, 16 May 1812; d. there, 1 April 1895. He became in 1853 a government official in the theatrical department; was elected to the Academy in 1876, and soon after made its standing secretary. The best known of his many very successful comedies are 'Un jeune homme' (1841); 'L'Avocat de sa cause' (1842); 'Le fruit défendu' (1857); 'La consideration.' His lyric pieces for the stage, 'Velasquez' (1847), and 'Le Barque' (1849), were crowned by the Academy.

DOUCET, Henri Lucien, French painter: b. Paris, 23 Aug. 1856; d. Saint Leu d'Essevent, 31 Dec. 1895. He was a pupil of Lefebvre and Boulanger, and won the Prix de Rome in 1880. Among his paintings are 'Adam and Eve'; 'Atala'; 'Après le bal'; 'Hagar'; and a number of portraits, including one of Mme. Galli Marie of the Opéra Comique.

DOUDNEY, Sarah, English novelist: b. Portsmouth, 15 Jan. 1843. She began writing when quite young and has published 'A Woman's Glory' (1885); 'The Missing Rubies' (1886); 'When We Two Parted' (1887); 'Where the Dew Falls in London' (1890); 'Through Pain to Peace' (1892); 'A Romance of Lincoln's Inn' (1894); 'Katherine's Keys' (1895); 'Pilgrims of the Night' (1896); 'A Cluster of Roses'; 'Lady Dye's Reparation' (1899); 'Silent Strings' (1900); 'One of the Few' (1904); 'Shadow and Shine' (1906).

DOUGALL, Lily, Canadian novelist: b. Montreal, Canada, 16 April 1858. She has published 'Beggars All' (1891); 'The Mermaid' (1895); 'The Madonna of a Day' (1896); 'A Dozen Ways of Love' (1897); 'The Mormon Prophet' (1898); 'The Spanish Dowry' (1906); 'Paths of the Righteous' (1908); 'Voluntas Dei' (1912); 'The Practice of Christianity' (1914).

DOUGHBIRD, a name given to several species of curlew (q.v.). but more especially to the Eskimo curlew (*Numenius borealis*).

DOUGHFACE, a nickname applied to Northern politicians who were inclined to yield to the Southern States in the antebellum agitation over States' rights and slavery. The term is traced back to 1820, when it was applied to the Northerners who supported the Missouri Compromise (q.v.).

DOUGHTY, dō'tē, **Arthur G.,** Canadian archivist: b. Maidenhead, Berkshire, England, 1860. He was educated at Eldon School, London, and at Oxford University, removed to Canada in 1886 and entered the service of the Legal and Commercial Exchange, Montreal. In 1897 he became private secretary to the Minister of Public Works, Quebec, and two years later to the Treasurer of the province of Quebec. From 1901 to 1904 he was joint librarian to the Quebec legislature and in the latter year was appointed Dominion archivist at Ottawa. He has written 'Life and Works of Tennyson' (1893); 'Rose Leaves' (1894); 'The Song Story of Francesca and Beatrice' (1896); 'Nugæ Canoræ' (1897); 'The Fortress of Quebec' (1904); 'The Cradle of New France' (1908); 'The Siege of Quebec,' with Dr. Parmelee (6 vols., 1902); 'Quebec under Two Flags,' with Dr. Dionne (1903); 'Canada and Its Provinces,'

with Professor Shortt (12 vols., 1916); 'A Daughter of New France' (1916); articles in 'The Catholic Encyclopedia,' the 'Encyclopedia Americana,' and the *American Historical Review;* and has edited Knox's 'An Historical Journal of the Campaigns in North America.'

DOUGHTY, Charles Montague, English explorer: b. Theberton Hall, Suffolk, 1843. He was educated at Cambridge, spent two years in Arabia making a study of the archæology, ethnography and geography of the country, the results of which were given to the public in 'Travels in Arabia Deserta' (1888). He published also 'Documents epigraphiques' (1884); 'The Dawn of Britain' (6 vols., 1906); Adam Cast Forth' (1908); 'The Cliffs' (1909); 'The Clouds' (1912).

DOUGHTY, William Henry, American surgeon: b. Augusta, Ga., 5 Feb. 1836; d. 1905. He received an academic education in Augusta, was graduated at the medical department of the University of Georgia in 1855 and in the same year began practice in Augusta, giving special attention to gynecology. From March 1862 to April 1865 he served as a surgeon in the Confederate army, being exclusively employed in hospital duty. He was successively surgeon-in-charge in the general hospitals at Macon, Ga., at Lauderdale Springs and at Augusta. In the course of this long service he tied the subclavian artery at its external third twice, which operations have passed into the permanent records of military surgery. From 1867 to 1875 he was professor of materia medica and therapeutics in the Medical College of Georgia. In 1887 he was a member of the International Medical Congress. His contributions to medical journals were numerous and embraced a wide range of subjects.

DOUGLAS, Scottish noble family. Their origin is unknown. They were already territorial magnates at the time when Bruce and Baliol were competitors for the crown, and like most of the Scottish nobility did homage and took oaths of allegiance to Edward I. They had estates both in England and Scotland but chiefly in Scotland. Eight miles from Lanark lies the village of Douglas, near which is the old church of Saint Bride and the site of Douglas Castle, their ancestral home. One of them, William Douglas, joined Wallace, was captured at Irvine in 1297, and died in the Tower of London in the following year. As their estates lay on the borders they early became guardians of the kingdom against the encroachments of the English, particularly of the Percies, who occupied a similar position on the English border, and acquired in this way power, habits and experience which frequently made them formidable to the Crown. The most important members of this family in chronological succession are:

JAMES, son of the William Douglas who had been a companion of Wallace, and is commonly known as the good Sir James, early joined Bruce, and was one of his chief supporters throughout his career, and one of the most distinguished leaders at the battle of Bannockburn. He fell in battle with the Moors while on his way to the Holy Land with the heart of his master in 1330. He had fought in 70 engagements, 53 of which were victories, and was buried in the church of Saint Bride.

ARCHIBALD, youngest brother of Sir James, succeeded to the regency of Scotland in the infancy of David. He was defeated and killed at Halidon Hill by Edward III in 1333.

THE EARLS OF DOUGLAS.

WILLIAM, son of the preceding, was created first earl in 1357. He recovered Douglasdale from the English, and was frequently engaged in wars with them. He fought at the battle of Poitiers. He died in 1384.

JAMES, the second earl, who, like his ancestors, was constantly engaged in border warfare, was killed at the battle of Otterburn in 1388. After his death the earldom passed to an illegitimate son of the good Sir James, Archibald the Grim, Lord of Galloway.

ARCHIBALD, son of Archibald the Grim, and fourth earl, was the Douglas who was defeated and taken prisoner by Percy (Hotspur) at Homildon, 14 Sept. 1402. He was also taken prisoner at Shrewsbury, 23 July 1403, and did not recover his liberty till 1407. He was killed at the battle of Verneuil in Normandy, in 1427. He was known as "Tineman" (the loser) because of his persistent ill-luck in war. Charles VII created him Duke of Touraine, which title descended to his successors.

WILLIAM, sixth earl, b. 1422, together with his only brother, David, was assassinated by Crichton and Livingstone at a banquet to which he had been invited in the name of the king, in Edinburgh Castle, 24 Nov. 1440. Jealousy of the great power which the Douglases had acquired from their possessions in Scotland and France was the cause of this deed.

WILLIAM, the eighth earl, a descendant of the third earl, restored the power of the Douglases by a marriage with his cousin, heiress of another branch of the family; was appointed lord-lieutenant of the kingdom, and defeated the English at Sark. Latterly having entered into a treasonous league, he was invited by James II to Stirling and there murdered by the king's own hand, 22 Feb. 1452.

JAMES, the ninth and last earl, brother of the preceding, took up arms with his allies to avenge his death, but was finally driven to England where he continued an exile for nearly 30 years. Having entered Scotland on a raid in 1484 he was taken prisoner and confined in the abbey of Lindores, where he died in 1488.

THE EARLS OF ANGUS.

The estates of the ninth earl, which had been forfeited in 1455, were bestowed on the fourth Earl of Angus, the "Red Douglas," the representative of a younger branch of the Douglas family, which continued to flourish long after. Thus, "the Red Douglas put down the Black." The fifth Earl of Angus, Archibald Douglas, was the celebrated "Bell-the-Cat," one of whose sons was Gawin Douglas, the poet (q.v.). He died in a monastery in 1514. Archibald, the sixth earl, married Queen Margaret, widow of James IV, attained the dignity of regent of the kingdom, and after various vicissitudes of fortune, having at one time been attainted and forced to flee from the kingdom, died about 1560. He left no son, and the title of Earl of Angus passed to his nephew, David. James Douglas, brother of David, married the heiress of the Earl of Morton, which title he received on the death of his

father-in-law. His nephew, Archibald, known as the "Guid," eighth Earl of Angus and Earl of Morton, died childless, and the earldom of Angus then passed to Sir William Douglas of Glenbervie, and the title went on in the Douglas line till William, 11th Earl of Angus, who was created Marquis of Douglas by Charles I. Archibald, the great-grandson of William, was raised in 1703 to the dignity of Duke of Douglas, but died unmarried in 1761, when the ducal title became extinct.

THE DOUGLAS CAUSE.

When the dukedom became extinct, the title of Marquis of Douglas and Earl of Angus went to the nearest heir-male, the Duke of Hamilton, a descendant of the first Marquis of Douglas. The estates, however, did not go with the title, and their disposal formed the subject of one of the most celebrated of Scottish lawsuits, known as the Douglas cause. The Duke of Douglas had a sister, Lady Jane, who at the age of 48 married Sir John Stewart of Grand Tulley. After the marriage they lived abroad. When in her 51st year Lady Jane, it was announced, had given birth to twin sons in Paris. At the duke's death in 1761 both father and mother were dead, and the surviving child became the heir to the duke. The succession was at once disputed by the Hamiltons, whose contention was that the story of the birth of the twins was false, and that in reality they were the children of French peasants, obtained for fraudulent purposes. For six years the contest went on in the Scottish courts; by the casting vote of the Lord President, Dundas of Arniston, in the final trial before 15 judges, decision was given against the claimant; but two years after the House of Lords reversed this judgment, and young Stewart became proprietor of the Douglas estates. The new heir was made a peer as Baron Douglas; his eight sons all died childless; but his eldest daughter married the 11th Earl of Home, whose son, the 12th Earl, now owns the property. Thus the Duke of Hamilton is head of the Douglases, but the Earl of Home is Lord of Douglasdale.

Two other peerages are held in the family: the Marquis of Queensbury, who descends from a natural son of the second Earl of Douglas slain at Otterburn; and the Earl of Morton, who descends from Douglas of Lochleven, the jailer of Mary Queen of Scots. Consult Sir William Fraser, 'The Douglas Book' (20 vols., Edinburgh 1899); and Sir J. Heron Maxwell 'History of the House of Douglas,' with the principal authorities prefixed thereto.

DOUGLAS, Alice May, American writer: b. Bath, Me., 28 June 1865. She has done editorial work for *Harper's Young People* and has been editor of *The Acorn* and *The Pacific Banner,* and is active in temperance and Sunday school work. She is also interested in peace work and was a delegate to the Boston Peace Congress. Her writings include in verse: 'Phlox'; 'May Flowers'; 'Gems Without Polish'; in prose: 'Jewel Gatherers'; 'The Peacemakers'; 'Self-Exiled from Russia' and 'A Friend Indeed.'

DOUGLAS, David, Scottish botanist: b. Scone, Perthshire, 1798; d. Hawaii, 12 July 1834. In the botanical garden at Glasgow, he attracted the notice of Sir William Hooker, who recommended him as a botanical collector to the Horticultural Society of London. He was accordingly, in 1823, sent by the society to the United States, where he procured many fine plants, and in particular increased the society's collection of fruit-trees. In 1824 he was sent on a second mission to explore the vegetation of the country adjoining the Columbia River, and southward toward California. In making the voyage he never lost sight of his object, and was able, during the short time the vessel touched at Rio Janeiro, to collect many rare orchidaceous plants and bulbs. He arrived at Fort Vancouver in April 1825, and sent home, from time to time, many beautiful plants, with seeds and dried specimens. A species of pine of gigantic size, one of several which he discovered, bears his name, *Pinus Douglasii.* In 1827 he crossed the Rocky Mountains and reached Hudson Bay, met Sir John Franklin and returned with him to England. The years 1829–32 were spent in California, and 1832–34 on the Fraser River. While on a visit to the Sandwich Islands he was gored to death by a wild bull.

DOUGLAS, Gawin, Scottish poet and bishop: b. about 1474; d. London 1522. He was the son of Archibald, Earl of Angus ("Bell-the-Cat"). Having taken orders in the church he received the living of Prestonkirk, and was also made provost of Saint Giles, Edinburgh, in 1501. In 1516 he was installed bishop of Dunkeld, but had an uneasy tenure of office; and while in England on a political mission was deprived of his bishopric and died of the plague. Gawin Douglas' great work is a translation of the 'Æneid' of Virgil (with the supplementary book of Maphæus) in heroic verse. It is the first translation of a Latin classic into any British tongue. It is executed with great spirit, and considering the age, with extraordinary elegance of diction. It was written about 1512, and is said to have been completed in 18 months. To each book is prefixed a highly poetical prologue. It was first published in 1553. Douglas also wrote 'The Palace of Honor,' an allegory of the virtuous life, and 'King Hart,' an allegory of the struggles of the human heart against the temptations of the flesh. A complete edition of his poems, edited by Small was published 1874. Consult the 'Cambridge History of English Literature,' Vol. II, and J. H. Millar's 'Literary History of Scotland' (London 1903).

DOUGLAS, George William, American clergyman: b. New York, N. Y., 8 July 1850. He was graduated at Trinity College, Connecticut, in 1871 and at the General Theological Seminary, New York 1874. He also studied at Oxford and at Bonn during 1874–76, was ordained to the Protestant Episcopal ministry in 1878 and became tutor at the General Theological Seminary in 1877–78. In 1878–79 he was assistant at Calvary Church, New York; was vicar of Trinity Church there in 1879–86. He became rector of Saint John's Church, Washington, and trustee of Washington Cathedral 1888–91. In 1895–98 he was rector of Trinity Church, New Haven, Conn. He was select preacher for Grace Church, New York, and instructor in the Training School for Deaconesses 1898–1904. Since 1904 he has been examining chaplain of the diocese of New York and senior canon of the cathedral of Saint John the Divine.

He has published 'Hints to Sunday School Teachers' (1883); 'Prayers for Children' (1884); 'Sermons Preached in Saint John's Church, Washington' (1893); 'Essays in Appreciation' (1912), also occasional public sermons, addresses, magazine articles, etc.

DOUGLAS, Henry Kyd, American author and jurist: b. Shepherdstown, W. Va., 29 Sept. 1840; d. Hagerstown, Md., 18 Dec. 1903. He was graduated at Franklin and Marshall College (1859), at the time when James Buchanan, afterward President of the United States, was a member of the faculty. He enlisted at Harper's Ferry in the Confederate army as a private in Company B of the noted "Stonewall" Jackson Brigade. He took part in the battle of Bull Run, and for his bravery was promoted until he rose to be a captain. In March 1862 he made a ride of 103 miles in order that General Ewell might at once join Jackson. This ride became celebrated in history. Horses were changed five times, and the ride was made through rain and mud. On his return he was promoted to inspector-general by Stonewall Jackson, with whom he served in every battle. At Gettysburg he was seriously wounded and was in prison nine months. His brigade was the last to surrender. Douglas was wounded nine times.

DOUGLAS, Sir Howard, English soldier and administrator: b. 1776; d. 1861. He entered the army and was present at the battle of Corunna. He was lieutenant-governor of New Brunswick 1823–29, and founded King's College, Fredericton, now the University of New Brunswick. He was commissioner of the Ionian Islands 1835–40 and represented Liverpool in the House of Commons, 1842–46.

DOUGLAS, James, American mining engineer: b. Quebec, Canada, 1837. He was graduated at Queen's University, Kingston, Ontario, in 1858. He taught chemistry for some time in Morrin College, Quebec, but removed to the United States in 1875, settling in Phœnixville, Pa., where he had charge of the copper works. He achieved a brilliant success as mining engineer and became president of a number of mining corporations and also of railroads in southwestern United States and northern Mexico. With the late Dr. T. Sterry Hunt he did much original work in hydrometallurgy of coppers. He is member and has served two terms as president of the American Institute of Mining Engineers. He published 'Canadian Independence'; 'Imperial Federation and Annexation'; 'Old France in the New World'; 'New England and New France' (1905), also numerous technical articles, reports, etc.

DOUGLAS, Sir James, English colonial administrator: b. West Indies 1803; d. Victoria, 1 Aug. 1877. He was educated at Lanark, Scotland, and Chester, England; was apprenticed to the North-West Company of Montreal; joined the Hudson's Bay Company in 1821, and in 1845 succeeded Dr. McLoughlin as head of the western department. He founded Fort Camosun, now Victoria, Vancouver Island, in 1843; was governor of Vancouver Island, 1851-63 and of British Columbia 1858–64. In these offices he displayed in a remarkable degree tact, resource and firmness in dealing with all classes of settlers, held in an uncommon measure the confidence of the Indian tribes and as a road builder made a permanent contribution to the welfare of the colonies.

DOUGLAS, John, English prelate: b. Pittenweem, Fifeshire, Scotland, 14 July 1721; d. Salisbury, England, 18 May 1807. He was educated at Oxford and in 1762 he was made canon of Windsor, which benefice he exchanged for a residentiary canonry of Saint Paul's. In 1751 he wrote 'Milton Vindicated from the Charge of Plagiarism.' In 1777 he prepared for the press the journal of Captain Cook's second voyage, to which he prefixed a well-written introduction and added notes; and in 1781 he edited the account of Captain Cook's third voyage. In 1787 he was raised to the see of Carlisle and in 1791 was made bishop of Salisbury.

DOUGLAS, Robert Langton, English author and critic: b. 1864. He was educated at New College, Oxford, taking honors in modern history. He was a lecturer on the University Extension Scheme and was formerly in holy orders in the Church of England. He executed a deed of relinquishment under the provisions of the Clergy Disabilities Act. In 1895–1900 he resided mostly in Italy; in 1900–02 was professor of modern history in the University of Adelaide, Australia. He also lectured on artistic subjects at the Royal Institution and the Society of Arts. He enlisted in the new army in 1914, was made captain in 1915 and transferred to the war office in the same year. Douglas has written much for magazines and reviews and is known as an authority on Sienese art. He has published 'Fra Angelico' (2d ed., 1902); 'History of Siena' (1902); 'Le Maioliche di Siena' (1904); a new edition of Crowe and Cavalcaselle's 'History of Painting in Italy' (1903); 'Illustrated Catalogue of Pictures of Siena and Objects of Art' (1904). He is a Fellow of the Accademia di Belle Arti, Milan.

DOUGLAS, Stephen Arnold, American politician: b. Brandon, Vt., 23 April 1813; d. Chicago, 3 June 1861. His father, a physician, died three months after his birth, and his mother was left with scanty means of support. At the age of 15 he apprenticed himself to a cabinet-maker and worked for two years at the latter's trade. Then, after a short term of study at the Brandon Academy, he accompanied his mother, who had married again, to a new home, near Canandaigua, N. Y., where he finished his schooling at an excellent academy, and where he began the study of law. He was interested deeply in political questions, even in these years, attaching himself with ardor to the new party of Democracy which General Jackson was then molding into form. In 1833 he left Canandaigua to seek a career in the West, and, after several months of ill-health and hardship, found employment for the winter in school-teaching at Winchester, Ill. In the spring of 1834 he was admitted to the Illinois bar and settled himself at Jacksonville, in that State. From that time his rapid rise to prominence was extraordinary, even among careers of ambition in the young West. Physically delicate and short in stature, his small body was so strikingly in contrast with the power massed in a big brain and exercised by an indomitable will that admiring Jacksonville promptly gave

him the name of the "Little Giant," which clung to him through life. Almost at once he became the acknowledged leader of his party in the town. A winning personality, an elastic temper, a fearless and ardent spirit, unbounded self-confidence and surpassing energy of intellect and will, were qualities that carried him always to the place of command. Within a year from his settlement at Jacksonville he was prosecuting attorney for his district; within two years he was seated in the legislature of the State; and from his service of a session in that body he passed into the office of United States Register of Public Lands, at Springfield, to which he was appointed by President Van Buren in 1837. His residence was at Springfield for the next 10 years, and there he came to acquaintance with Abraham Lincoln, his great political antagonist of a later time, whose rise to eminence was much slower than his own. In 1838 the bold young Jacksonian very nearly won an election to Congress in the strongly Whig district to which Springfield belonged. In 1841 he was appointed to a judgeship in the Supreme Court of the State, but resigned his seat on the bench two years later, to present himself again as a candidate for Congress, and with success. At that time (1843) he had just passed his 30th year. Most newcomers in Congress, even the ablest, need time to make a position of influence for themselves; but Douglas was prominent among the Democratic representatives of the Northwest from the first. The vigorous activity of his mind and the remarkable quickness of its working made him formidable in debate, while the unhesitating resoluteness with which he threw himself into whatever he undertook carried him always to the front of the fighting line. At the beginning of his second term in the House of Representatives he was made chairman of its Committee on Territories; and when, at the end of that term, he was elected to the Senate (1845), he received the chairmanship of the same committee in that body. This gave him the direction of subjects in legislation which events were making more important and more exciting than any others in the politics of the time. Texas had just been annexed; the country was on the eve of a war of conquest with Mexico and Great Britain was negotiating a fair settlement of the Oregon dispute. Should an expansion of national territory mean expansion of slavery, and, if so, to what extent? were the questions now rising in angry debate. They were brought into Congress by the famous resolution called the "Wilmot proviso," which declared that no slaves should be held in any territory acquired as the result of the Mexican War. Extremists on the pro-slavery side set up the opposing doctrine that slave-holding was a constitutional right in any territory, since slaves were a species of property recognized by the Constitution of the United States. A second ground of opposition to the Wilmot proviso was discovered, apparently first by General Cass, who contended that the inhabitants of each Territory should admit or exclude slavery as they pleased, by their own votes. This doctrine of "popular sovereignty," or "squatter sovereignty," as it was branded scornfully by Calhoun, commended itself to Douglas' mind. His attitude toward slavery was that of indifference to the right or wrong of the system, which he regarded confessedly as a problem in politics, and no more. Practically, the "squatter sovereignty" doctrine triumphed in the compromise measures of 1850, which admitted California to the Union under the free-State constitution that her people had framed, and organized New Mexico and Utah as Territories with no restriction concerning slavery. Excepting Henry Clay, no one did more than Douglas in the framing of those measures and carrying them through. He was now so conspicuous among the chiefs of the Democratic party that he could aspire to its nomination for President in 1852. From the North he received strong support; but the less known and more pliant Franklin Pierce was preferred at the South. Douglas, not yet 40 years of age, could afford to wait. At some time within the next two years he conceived his project for a more complete and final settlement of the slavery question than the compromise of 1850 had brought about. This, in his view, could be accomplished by a frank and full adoption of the principle of "popular sovereignty," applied to the whole national domain. Accordingly, in 1854, he startled the country by reporting from his committee what was known in its final form as the Kansas-Nebraska Bill, repealing the Missouri Compromise of 1820 (which excluded slavery from the territory of the Louisiana Purchase, north of 36° 30') and leaving "the inhabitants thereof perfectly free to form and regulate their domestic institutions in their own way." At the North the bill raised a storm which even the bold spirit of Douglas must have watched with alarm. His own party was torn by it; that of the Whigs had already gone to pieces, and two new parties, "Know Nothing" or American, and Republican, now emerged from what seemed to be a general wreck of all in politics that belonged to the past. But Douglas, with no sign of faltering, fought a wonderful battle for his bill and carried it through. Then came the test in practice of his policy, applied in a struggle between anti-slavery and pro-slavery forces to control the settlement and the constitution-making of Kansas. The test was not favorable to the prestige of Douglas. He had heated instead of cooling the agitation of the slavery question and made it more dangerous than before. As a candidate for the presidency he was hardly so strong in 1856 as in 1852; but after Buchanan, then elected, had driven Douglas to revolt, by countenancing the fraud of the Lecompton constitution, making a farce of "popular sovereignty" in Kansas, the manly course of the Illinois Senator gave him more of popularity in the free States than he lost in the South. The hostility of the administration, combining with the opposition of the new Republican party, already powerful in the Northwest, could not defeat his re-election to the Senate in 1858. Over any antagonist but Lincoln he would probably have won a great triumph; as it was, he came wounded from his debates with that extraordinary man. He had been forced to declarations that offended his party in one section of the country more than they satisfied it in the other, and made him the occasion of a hopeless breach between the two. Nominated for President at last in 1860 by one wing of a divided party, he fought his last political battle with

all of his old obstinate valor, and went down in defeat. He was at the end of the small gift of bodily strength that he received at his birth; he had worn it out. He survived the election of Lincoln only long enough to stretch a loyal and supporting hand to his successful rival in the crisis of rebellion that ensued. His last words to his followers were: "There can be no neutrals in this war." Consult Johnson, Allen, 'Stephen A. Douglas' (New York 1908); Brown, W. G., 'Stephen Arnold Douglas' (Boston 1902); Carr, E. C., 'Stephen A. Douglas' (Chicago 1909); Sheahan, J. W., 'Life of Stephen A. Douglas' (New York 1860); Rhodes, J. F., 'History of the United States from the Compromise of 1850' (7 vols., New York 1906).

DOUGLAS, Sir **William Fettes,** Scottish painter: b. Edinburgh, 12 March 1822; d. 20 July 1891. As a painter he was mainly self-taught. On first devoting himself to art he practised chiefly as a landscape painter, but he soon turned to figure subjects, producing 'Hudibras and Ralph visiting the Astrologer' (1856); 'Lovel and the Antiquary' (1857); 'The Summons to the Secret Tribunal' (1860); and 'The Magic Mirror' (1872); works distinguished by excellent coloring and by especially firm, careful and refined handling. His later years were entirely devoted to landscape water-colors. He is represented in the National Gallery of Scotland by 'The Messenger of Evil Tidings'; 'The Spell'; and 'The Bibliophilist.' He was elected president of the Royal Scottish Academy in 1882 and was knighted in the same year.

DOUGLAS, William Lewis, American manufacturer and public official: b. Plymouth, Mass., 22 Aug. 1845. He was educated in the public schools, began work in a shoe factory at the age of seven, removed to Colorado in 1865 and returned to Brocton, Mass., in 1876. He established a shoe factory there in the latter year, from which he has built up a business with a capacity of 17,600 pairs of shoes daily to supply his 85 retail stores in the large cities. In 1884–85 Douglas was a member of the Massachusetts house of representatives, and of the State senate in 1887. He was elected mayor of Brocton in 1890 and governor of Massachusetts in 1905. He also served as delegate to the Democratic national conventions of 1884, 1892, 1896 and was delegate-at-large in 1904.

DOUGLAS, England, capital of the Isle of Man, and a popular summer resort. Pop. 21,183.

DOUGLAS CITY, Alaska, town on Douglas Island, opposite Juneau. It is occupied chiefly by miners from the nearby Treadwell gold mines. There is a government school in the native quarter for the instruction of the Tlinkit children. Pop. 1,722.

DOUGLAS FIR. See Fir.

DOUGLASS, Frederick, American lecturer and journalist, the son of a negro mother who was a slave: b. Tuckahoe, Md., February 1817; d. Washington, D. C., 20 Feb. 1895. Although his father was a white man, he was, according to the law, reared as a slave. In 1832 he was purchased by a Baltimore shipbuilder, but made his escape in 1838. He had taught himself to read and write, and changed his name from Frederick Augustus Bailey to Douglass. He worked as a day laborer in New York city and in New Bedford, Mass. At an anti-slavery convention at Nantucket in 1841, he showed talent as an orator, and was employed by the Anti-Slavery Society as one of its lecturers. In 1845 he published his 'Autobiography,' and afterward made a successful lecturing tour in England. His freedom was bought while he was abroad. In 1870 he edited a journal entitled *The New National Era;* in 1871 he was appointed secretary of the commission to Santo Domingo; in 1872, presidential elector; in 1877, marshal for the District of Columbia, then commissioner of deeds for that district, and in 1889, United States Minister to Haiti. His autobiography was revised and enlarged in 1882 under the title of 'Life and Times of Frederick Douglass.' Consult Washington, Booker T., 'Frederick Douglass' (Philadelphia 1907).

DOUKHOBORS, doo'hō-bōrz (Russian *dukhobortsy,* "spirit wrestlers," from their vanquishing the doctrine of the Holy Spirit), a sect which started in Kharkov, Russia, about 1740, and spread rapidly in the Dnieper provinces who now call themselves Christians of the Universal Brotherhood. The founder's name is not preserved: he was a Prussian sub-officer who settled in Russia when his term expired. He and his successors, Kolesnikoff, Kapustin, etc., taught the familiar doctrine of the "inner light," with logical but socially inconvenient extensions: that as God in the soul is the one guide to action, the Bible is not inspired (though they accept the 10 Commandments), and it is not only superfluous but sinful to read and write, printing being a snare of the Devil; that God manifests himself in the fullest power in the human soul, and as they had that power, they were embodiments of God, and to be worshipped and obeyed as such; that Christ was only a sinless man, and the sinless leaders were his equals and successors. Every one's action being dictated by God, it cannot be wrong, and civil rulers are needless and their rule a usurpation; all being equal before God, churches are needless and they do not enter them; marriages need neither ceremonies nor permission, being of inclination only. It is easy to see that these tenets brought them in conflict with the authorities, who tried to restrict them to theory instead of practice, and imprisoned numbers for contumacy; but in 1801 a commissioner's report to Alexander I that they were well-behaved citizens induced him to order them left alone. The first colony was founded at Milky Waters, Sea of Azov, in 1801, and by 1816 the community numbered 3,000 souls. Crimes committed in the internal management of the colony led to their deportation (1841–44). The report of an imperial commission was so shocking that they were deported to the then wilderness of Transcaucasia; a high bleak plateau unfit for agriculture, where they became almost wholly cattle-raisers and eaters, and increased to some 15,000. The government gradually put down the civil despotism of the leaders, and enforced decency of life; but it was not done without much petty tyranny, and doubtless corruption and abuse, of which they complained. Then came Pobiedonosteff's policy of unifying the elements of the empire, and

enforcing conformity to the Greek Church; and in 1887 a bitter faction fight between two pretenders to the Doukhobor leadership rent the community. In 1895, as a sign that they regarded war as sinful, a large number destroyed all weapons of offense, and on account of this about 4,000 were deported from their homes and scattered among the Georgian tribes. Championed by Tolstoi, an agitation in their favor sprang up in England and other countries; and in 1898 the Russian government agreed to permit their emigration. About 1,000 went to Cyprus, these afterward joining the main body in Manitoba, where between January and June 1899 7,363 located, settling in the vicinity of Yorkton, Swan River and Prince Albert. They would not take lands in severalty, but only in communities; but they were prospering and learning English, filling the schools with their children, and appearing to slough off their unassimilable characteristics. Suddenly they adopted the tenet that all use of animals or their products for human service is sinful, and refused to eat milk, butter or eggs, wear woolen or leather garments, or use draft animals. Then one settlement refused to pay school taxes, till the government seized and sold their cattle. In the summer of 1902 they all at once turned their stock loose on the prairies and began hauling their own loads to market, sometimes 50 miles off, and themselves drawing the plows; the government rounded up the stock, sold it and placed the proceeds to the credit of the communities. While crippled in power to work for lack of animals, the rumor spread that Jesus was shortly to appear at Winnipeg, 300 miles east, to lead them to a new kingdom; they deserted the villages, and on the night of 27 October 1,500 to 2,000 set off across country. After dreadful sufferings from cold and hunger, and joined by thousands more, men, women and children, they came near Yorkton 10 days after, and lay out in the fields with the thermometer at 22°. The police singled out the women and children and the sick, and locked them into comfortable quarters; several hundred of the men went on alone, the women clamoring to accompany them and some going insane. When about 100 miles from Winnipeg, the mounted police forced them into freight cars and took them back to their villages. Pilgrimages on a small scale have since taken place, in each year from 1903 to 1907, but those have occasioned little trouble. Peter Veregin, their leader, has on their behalf made extensive purchases of fruit-lands round Nelson, British Columbia. About 35 per cent of the immigrants have broken away from the community to start on their own account. According to the Canadian census of 1911, there were 10,943 in the Dominion. Consult Elkinton, 'The Doukhobors' (Philadelphia 1903); Maude, 'A Peculiar People: The Doukhobors' (New York 1904).

DOULS, dool, **Camille,** French explorer: b. Rodez 1864; d. 1889. He made his first tour of exploration in 1887, visiting southern Morocco disguised as a Mussulman merchant. He was captured and thrown into prison by one of the native tribes, was later liberated and managed to reach Morocco. In the following year he set out to cross the Sahara to Timbuktu. After he had penetrated far into the interior he was assassinated by his two Tuareg guides. An account of his first exploration trip is given in 'Bulletin de la Société de Géographie' (1881), *Revue de Géographie* (1888) and 'Le tour du monde' (1888).

DOULTON, Sir **Henry,** English potter: b. Lambeth, 24 July 1820; d. 19 Nov. 1897. At 15 he entered his father's establishment there, where he devoted himself to the most technical branch of the industry, and worked for many years at the potter's wheel. In 1846 he commenced the manufacture of stoneware pipes for sewage and drainage, for which a special factory was erected near Lambeth Palace, and thus initiated the substitution of impervious pipes for the old flat-bottomed brick drains. Sir Henry Doulton, however, is chiefly noteworthy as having been mainly instrumental in bringing about the revival in art pottery which has since spread into every civilized country; and his firm's works in art stoneware, silicon, impasto, terra-cotta, faience and Doulton wares, have since 1870 gained the highest awards of judges at every exhibition of note throughout the world. John Bennet of the Lambeth works introduced the ware into the United States. He was created a Chevalier of the Legion of Honor (1878); was awarded the Albert medal in 1885; and in 1887 was knighted on the occasion of the queen's jubilee.

DOUM NUT, the seed of the common palm (*Hyphen thebacia*) found throughout northern Africa. It is used as a substitute for vegetable ivory in the manufacture of buttons. The palm itself is a small tree, rarely over 30 feet in height, and often forked. The fruits grow in clusters of from 1 to 200 each. The nut is known to commerce under the trade name of gingerbread doum, doom or dum. It is softer than the tagua or corozo ivory nut of South America, has a thicker coating and a large hole in the centre. To offset this it is available in much larger quantities and is much cheaper, the price on the market fluctuating from two to three cents per pound. The quantity exported from Africa is constantly increasing. It is now much used in Italy, France and Germany, and is gradually finding favor in the United States.

DOUMER, doo'mā', **Paul,** French statesman: b. Aurillac, Cantal, 1857. In 1885 he was appointed chief assistant to Floquet, president of the Chambre des Deputés. In 1888 and again in 1890 he was elected to the Chambre as a Radical. In 1895–96 he was Minister of Finance in the Bourgeois Cabinet and in the latter year was appointed governor-general of French Indo-China. Here he put through several important public works and placed the finances of the colony on a secure basis. In 1902 he was again a member of the Chambre, and served as head of the Budget commission, and, in 1905, as president of the Chambre. In 1906 he was the candidate of the Moderates and Reactionaries for the presidency, but was defeated by Armand Fallières, receiving only 371 votes to 449 for the latter. He was again head of the Budget commission in 1909, but failed of re-election in 1910. He is the author of 'L'Indo-Chine française' (1904) and 'Livre de mes fils' (1905).

DOUMERGUE, doo'mėrg', **Emile,** French Protestant historian: b. Nimes 1844. He re-

ceived his education at Geneva, Montauban, Erlangen and Berlin. From 1871 to 1880 he was editor of the periodical *Le Christianisme au XIXe Siècle*. He also received the appointment of professor of Church history and dean of the Protestant theological faculty at Montauban. His greatest work is his biography of Calvin, 'Jean Calvin: les hommes et les choses de son temps' (5 vols., Vol. I, 1899; Vol. IV, 1910). Another important work is 'Iconographie calvinienne' (1909).

DOUMERGUE, Gaston, French statesman: b. Aigues-Vives, Gard, 1863. He studied law, practised at Nimes in 1885–90, served as colonial magistrate in Cochin-China in 1888 and in Algiers in 1890–93. He was elected to the Chamber of Deputies as a Radical-Socialist in 1898, 1902 and 1906. In 1895–96 he was secretary and in 1905–06 vice-president of the Chamber. In 1902–05 he was Minister of the Colonies in the Combes Cabinet, in 1906–08 Minister of Commerce in the Sarrien and Clémenceau cabinets, and in 1908–10 was Minister of Public Instruction in the Clémenceau and first Briand cabinets. Afterward he became a member of the Senate and in December 1913 was made Premier, holding at the same time the portfolio of foreign affairs. He resigned the premiership in June 1914. In 1915 he became Minister of the Colonies in the Briand Cabinet.

DOUMIC, doo'mēk', **René,** French literary critic: b. Paris 1860. He was educated at the Lycée Condorcet and at the Ecole Normale Supérieure. He came to America, where he served as professor at Stanislas College; he lectured in Canada and at Harvard University in 1898. He has become known internationally through his criticisms in the leading journals of France. He was made a Chevalier of the Legion of Honor and was elected member of the Academy in 1909. He has published 'De Scribe à Ibsen' (1893); 'Ecrivains d'aujourd'hui' (1894); 'Etudes sur la littérature française' (5 vols., 1896–1905); 'Les jeunes' (1896); 'Essais sur le théâtre contemporain' (1897); 'Hommes et idées du XIXe siècle' (1903); 'Les lettres d'Elivre à Lamartine' (1905); 'Le théâtre nouveau' (1908); 'George Sand' (1909); 'Lamartine' (1912); 'Histoire de la littérature française' (30th ed., 1913).

DOUNE, Scotland, village of Perthshire, on the Teith, nine miles north of Stirling. Doune Castle, a fine specimen of Scottish baronial architecture, now a ruin, is described in Scott's 'Waverley.' Pop. 893. At Deanston, a mile west, are large cotton-mills, long managed by James Smith, a noted inventor and philanthropist.

DOURINE, or **MALADIE DU COIT,** a specific infectious disease of the horse and ass, transmitted by the act of copulation. It is caused by a protozoan parasite (*Trypanosoma equiperdum*). A symptom of the disease is an irregular period of incubation and it is characterized by the confinement of the first symptoms to the genital tract, the chronic course which it runs, and by the final complete paralysis of the posterior extremities, terminating fatally in from six months to two years. The disease is common in Asia, Africa and Europe and has been introduced into the United States several times with imported stallions. The United States Department of Agriculture is still engaged in eradicating the disease in certain sections of the West. The disease is detected by the blood test known as complement fixation. Consult 'Bulletin 142' (United States Department of Agriculture, Bureau of Animal Industry, Washington D. C.); Hoare, E. W., 'System of Veterinary Medicine' (Vol. I, 2d ed., New York 1906); Hutyra and Marek, 'Pathology and Therapeutics of the Diseases of Domestic Animals' (Vol. I, London 1912).

DOURO, dō'roo, or **DUERO,** doo-a'rō (ancient DURIUS), one of the largest rivers of the Spanish Peninsula, which, flowing west, traverses about one-half of Spain and the whole of Portugal, and, after a course of 500 miles, flows into the Atlantic three miles below Oporto. It is not of much navigable importance, but small vessels ascend about 70 miles from its mouth. In the Middle Ages it was celebrated for the gold that was found in its bed.

DOUROUCOULI, doo-roo-koo'lē, a small Brazilian monkey, of nocturnal habits, which sleeps by day, and preys fiercely by night upon insects and small birds. It is of the genus *Nyctipithecus*, of which various species are known, all South American. They are about nine inches long, with tails somewhat longer than their bodies; and have soft grayish fur; their voices are discordant and disagreeable. They are known also as "owl-monkeys," and "night-monkeys."

DOUSA, Janus (Latinized from JAN VAN DER DOES), Dutch statesman, philologist, historian and poet: b. Noordwyk, Holland, 6 Dec. 1545; d. there, October 1604. In 1572 he went as Ambassador to England to obtain the support of Queen Elizabeth for the cause of the Dutch and subsequently became governor of Leyden. As chief commander, during the siege of Leyden by the Spaniards, he conducted himself with prudence and courage in the midst of the horrors of famine, plague and civil dissensions. He was sent to England again in 1584 and 1585. The stadtholder, William I, compensated the city for its sufferings by the establishment of the university, of which Dousa was the first curator. His best-known work is 'Bataviæ Hollandiæque Annales' (1599).

DOUW, Gerard. See DOW, GERARD.

DOUZETTE, dow'zĕt, **Louis,** German painter: b. Triebsees, Pomerania, 25 Sept. 1834. He received a gold medal at Berlin in 1886. He is a landscape painter almost exclusively, and is particularly noted for his moonlight effects. Among his works are 'Moonlight on the Fjord' (1883) in the Dresden gallery; 'Swedish Coast by Moonlight' (1866); 'Harbor of Lübeck by Moonlight' (1891). He was especially influenced by the Dutch.

DOVE, dō'vĕ, **Alfred,** German historian: b. Berlin 1844. He was a son of Heinrich W. Dove (q.v.) and studied medicine and the physical sciences at Heidelberg and Berlin in 1861–66. Entering the journalistic field he was successively editor of the *Grenzboten* (1870) and of the periodical *Im Neuen Reich*. From 1874 to 1884 he held the chair of history at Breslau, and the same chair at Bonn from 1884 to 1891. In the latter year he returned to journalism and

for a short time was editor of the *Allgemeine Zeitung* in Munich. He published 'Deutsche Geschichte im Zeitalter Friedrichs des Grossen und Joseph II,' but the literary world is especially indebted to him for publishing the posthumous manuscripts of Von Ranke, completing in four years the 'Weltgeschichte' and editing the 'Sämtliche Werke' (1890). In the year following he edited the last volumes of Bismarck's parliamentary speeches.

DOVE, Heinrich Wilhelm, German physicist and meteorologist: b. Liegnitz, 6 Oct. 1803; d. Berlin, 4 April 1879. He was educated at Breslau and Berlin, and in 1845 he was appointed professor of natural philosophy at the university of the latter city, a post which he held till his death. He was also director of the Royal Observatory. Among his numerous works are 'Meteorological Researches' (1837); 'Distribution of Heat on the Surface of the Globe' (1852); 'Law of Storms' (1857); 'Optical Studies' (1859), and many papers in various journals.

DOVE, originally applied in England to several native and domesticated species of the genus *Columba;* the name dove is now used generally for the smaller species of the pigeon family (*Columbidæ,* q.v.), but in many cases interchangeably with pigeon. The name applies to about 10 native North American species, of which the most important are the mourning dove (*Zenaidura macroura*), the white-winged dove (*Melopelia leucoptera*), the ground dove (*Columbigallina passerina*), and several species of ground dove, of which only the first extends its range northward, the others being more especially derived from the West Indian and Mexican fauna, which includes many additional species. The mourning dove, so-called on account of its plaintive call, and unadorned plumage, ranges and breeds throughout temperate North America. The nest is a loose structure of twigs in which two eggs are deposited. In the late summer and autumn, when congregated in small flocks, doves are sometimes destructive to crops, and are much sought by gunners in localities where the game laws permit.

Several species of European and other exotic doves are well known in this country in the domesticated state. The ring dove (*Columba palumbus*) occurs throughout Europe, collecting in large flocks during the winter and depredating fields of turnips and other crops. The rock dove, or rock pigeon (*C. livia*) is considered by Darwin ('Animals and Plants Under Domestication') to have been the original stock of our domesticated pigeons, which, as a result of careful selection, have diverged into many races, arranged by Darwin in four principal groups: (1) Pouters; (2) Carriers, Runts and Barbs; (3) Fantails, Tumblers, Turbits, etc.; and (4) Trumpeters — which lead through some little modified varieties to the original stock still existing on the coasts of Europe and North Africa.

The turtle dove (*Turtur communis*) of Europe has been universally adopted in Christian countries as the emblem of gentleness and love, and figures much in poetry. It also symbolized loveliness, and was applied in this sense to women. The dove was the bird of Venus; Babylon was the city of the dove; it was a dove that whispered into the ear of Mohammed, and was his oracle. It was embodied in the pagan worship of ancient Europe, and held a place in funeral rites. The dove was a sacred bird to the Israelites, typefying innocence, and Jerusalem was the city of the dove. In Christian times it was the attribute of the Virgin Mary; was a symbol of the Holy Ghost, and carved on baptismal and communion vessels and on the tombs of martyrs as a figure of the resurrection.

DOVE IN ART. Semiramis was symbolized by the ancient Assyrians and Babylonians by a dove, the form she is supposed to have assumed on leaving the earth. Venus (Astarte) is generally found accompanied by a dove as an attribute, in mythological art. In Christian symbolism the dove is figurative of the Holy Spirit. In this sense it figures in pictorial representations of such scenes as the baptism of Christ, the annunciation of the Virgin, the creation of the world; with the same intent artists have introduced the dove hovering over the heads of saints. Again, for the same reason the dove form was carved on most baptismal fonts of the older churches.

As Noah's messenger returning to the Ark with an olive branch, the dove has become a symbol of peace, and accompanies the inscription «Pax» in the Catacombs. Figuring on tombs or sarcophagi the dove is said to represent grief and martyrdom. In profane symbolism the dove usually represents love or affection: Giovanna de Medici adopted two turtle doves as her device to represent conjugal fidelity.

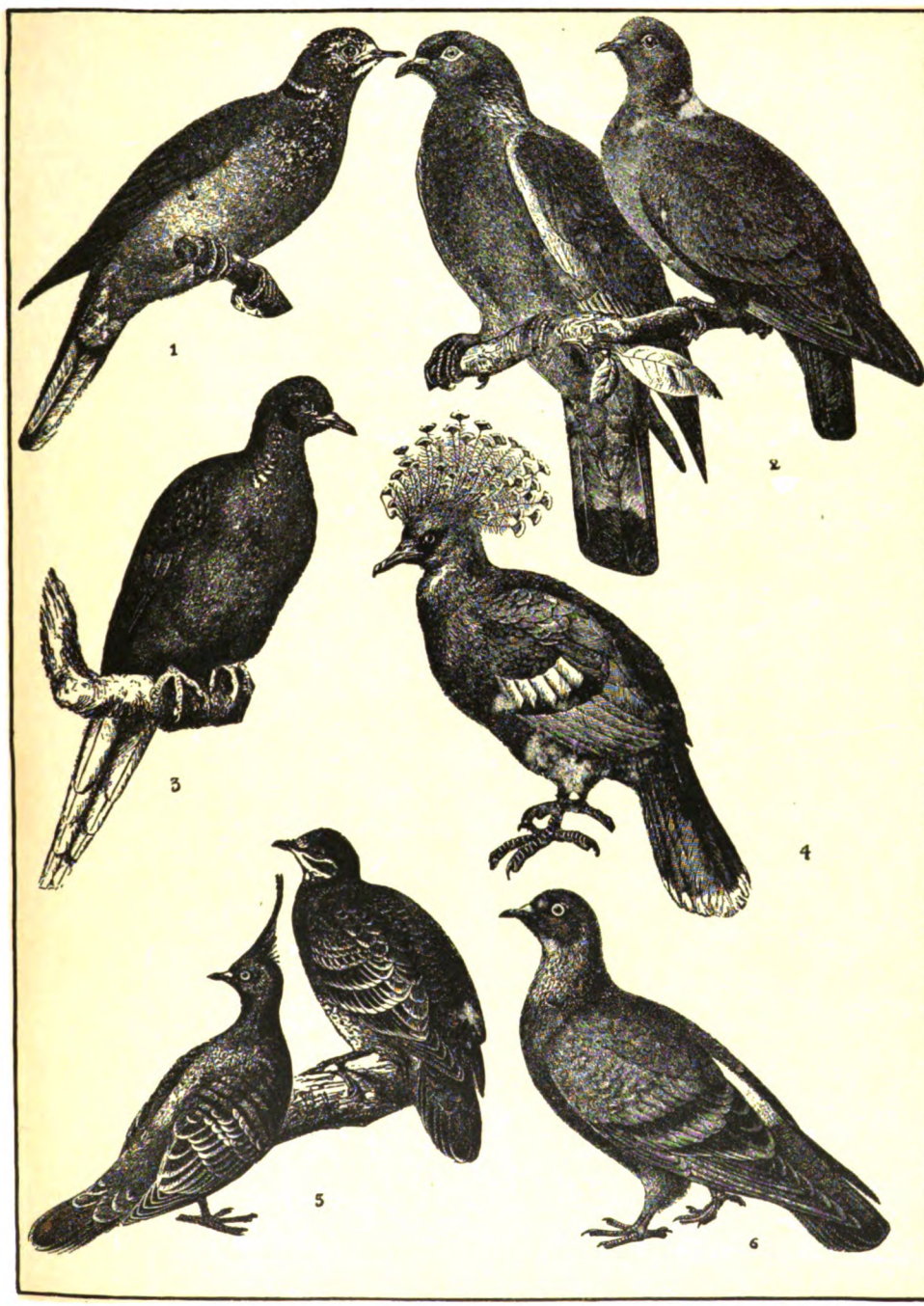
In ecclesiastical furniture the pyx (containing the consecrated Host) suspended from the ciborium over the altar in the earlier Roman Catholic churches frequently took the form of a dove; it was known as the *peristerium,* from the Greek *peristeirion* — a dove-cote. Dr. Rock says they were used in many French churches up to a century or so ago; the custom appears to have died out generally long before as none are known to have been produced later than 1200 A.D. The dove stood, usually, on an enamel-decorated dish from which it was detachable. Very few specimens of these ecclesiastical doves are extant. In Germany, the Salzburg and Erfurt cathedrals and the monastery church of Gottweih each possess one. Numerous saints have been depicted as accompanied by a dove, such as: Saint Thomas Aquinas, Saint Fabian, Saint Gregory the Great, Saint Louis, Saint Dunstan and a number of others.

DOVE-PLANT, or HOLY GHOST PLANT (*Peristeria elata*), an orchid of Central America, much reverenced by the pious natives because of its resemblance to a dove with outstretched wings, the symbol of the Holy Ghost; called also Holy-Spirit flower.

DOVE-TICK, a bird parasite (*Argas reflexus*), the blind tick which infests doves and other birds. Some of the species are said to cause death by their sting. See TICK.

DOVEKIE, dŭv'kĭ, the little auk (*Alle alle*), one of the smallest of the family *Alcidæ,* a bird of high northern latitudes, living and breeding gregariously, on rocky sea-coasts of the North Atlantic and Arctic oceans. A single egg is laid by this bird on the bare rock. In winter, it is found along the coast of New Eng-

REPRESENTATIVE DOVES



1 Domestic Turtle-dove (Turtur risorious)
2 European Wood-pigeon (Columba palumbus) at the left; and Stock-dove (C. œnas) at the right
3 American Wild or Passenger Pigeon (Ectopistes migratorius)
4 Papuan Crowned Pigeon (Goura albertisi)
5 Crested and Common Australian Bronze winged Doves
6 Blue Rock-dove (Columbia livia)

land and the Middle States, and is occasionally blown by storms as far inland as Michigan. The dovekie, or sea dove, as it is also sometimes designated, is from eight to nine inches long; of a glossy blue-black above, with the under parts, and two patches on each wing, white. The adults have a small crest on the base of the beak.

The name is also sometimes applied by fishermen to one or more species of guillemot.

DOVER, Del., city, capital of the State and county-seat of Kent County, on Jones Creek, and the Philadelphia, Baltimore and Washington Railroad, 75 miles south of Philadelphia. It is the seat of Wilmington Conference Academy and has a handsome monument erected to the memory of Cæsar Rodney, one of the signers of the Declaration of Independence. It is the centre of a great fruit-growing region. It is on high ground; is laid out with wide, straight streets that cross each other at right angles; and is built up chiefly with brick. Among its noteworthy buildings are a handsome State house, large courthouse and new United States government building. Connected with the State house is a State library with upward of 50,000 volumes. There are several churches, a national and a State bank, fruit evaporating and packing establishments, steam flour-mill, foundry, machine shop, and sash, fruit crate, glass and carriage factories. The city has valuable gas and waterworks, weekly newspapers and good schools. Dover was laid out in 1717, became the capital of Delaware in 1777 and was incorporated as a town in 1829. The government is vested in a mayor and eight councilmen. Pop. 3,720.

DOVER, England, a Cinque port and parliamentary and municipal borough in the east of Kent, England, 78 miles southeast of London by rail and 22 miles from Calais. Owing to its mild and equable climate, it is a favorite seaside and pleasure resort. Its trade is almost entirely with the Continent, to and from which there is a great passenger traffic. The Duke of York's School, formerly at Chelsea, is now located here. It is the headquarters of the Southeastern District of the British army, and the nearest point of the English coast to France. The fortifications comprise Dover Castle, which occupies a commanding position on the chalk cliffs, 375 feet above the level of the sea, and still includes some of the old Saxon and Norman work and three modern forts of great defensive strength have recently been constructed. As the gateway of England fronting the Narrow Seas, Dover has always held an important place in schemes of national defense. One end of the submarine net which was constructed across the English Channel during the great European War was at Dover. Among the antiquities of Dover are a Roman pharos and a Roman-British fortress church. The borough returns one member to Parliament. Pop. 44,000.

DOVER, N. H., city and county-seat of Strafford County, 11 miles by rail northwest of Portsmouth, at the head of minor navigation on the Cocheco River, and on the Boston and Maine Railroad. The city has fine power facilities derived from the Cocheco River, which here has falls over 30 feet high. It contains cotton and woolen mills. printing press factories, machine works, boot and shoe factories, leather belt works, iron castings works, cutlery works, brick and lumber yards, etc. The United States census of manufactures for 1914 recorded within the city limits 58 industrial establishments of factory grade employing 2,678 persons; of whom 2,483 were wage earners, receiving annually $1,219,000 in wages. The capital invested aggregated $5,703,000, and the year's output was valued at $5,682,000: of this, $1,425,000 was the value added by manufacture. Its principal public buildings are the city hall, public library, opera house, two hospitals, home for the aged, two orphan homes and three banks. The total value of its taxable property is estimated at $10,686,000. The government is vested in a mayor, elected for two years, a board of aldermen and a common council. The waterworks are the property of the city and are operated by the Municipal Water Commission. Dover was settled in 1623 and is the oldest city of New Hampshire; was organized as a township 10 years later, and received its city charter in 1855. In its first century of existence it experienced all the anxieties of a frontier town, being often attacked by the Indians, the worst affair of this nature occurring in 1689 when several buildings were burned, 29 persons taken prisoners and 23 slain. Pop. 14,000.

DOVER, N. J., town in Morris County, 39 miles by rail west of New York, on the Rockaway River, the Morris Canal, the Delaware, Lackawanna and Western and the Central of New Jersey railroads. It has machine shops, large iron works, stove and furnace factories, boiler works, flouring mills, drill and range factories, silk mills, knitting mills, hosiery factories, overall factory and a government munition depot. It is governed by a mayor, elected biennially, a recorder, board of aldermen and a common council. All these together form the Municipal Council. In 1826 the place was incorporated as a village, and as a town in 1869; its present charter was granted in 1875. Its chief public buildings are the city hall, two banks, several churches and public schools. The total value of all its taxable property is placed at $8,000,000. Pop. 11,000.

DOVER, Tenn., town and county-seat of Stewart County, 100 miles west of Nashville, and 15 miles from the Kentucky State line, on the south bank of the Cumberland River. It is about 16 miles from the Louisville and Nashville and five miles from the Tennessee and Cumberland River railroads. The county is almost wholly agricultural. Dover is the market for practically the entire county. It has two banks, a public school, courthouse and an assessed valuation of $200,000. It is governed by a mayor and board of aldermen. Dover is located about half a mile from the site of Fort Donelson, where a three days' battle was waged in February 1862. The Fort Donel n National Cemetery is in the suburbs of the town. Dover was almost destroyed during the Civil War. The house in which General Grant received the surrender of the fort is still shown in the town. It was first settled in 1806. Pop. 600.

DOVER, Strait of, the narrow channel which connects the North Sea with the English Channel, and separates England and France. At the narrowest part from Grisnez to Dover—

it is only 21 miles wide. The depth of the channel at a medium in the highest spring tides is about 180 feet. On both the French and English sides the chalky cliffs show a correspondency of strata which leaves no room for doubt that they were once united. Various projects for connecting Dover and Calais more closely have been advanced, as by bridge or tunnel or by trains on submerged rails. When making examinations for the tunnel scheme, coal was discovered in the bed of the Strait.

DOVETAIL, a term used in carpentry; the fastening of boards together by letting one piece into another, in the form of the tail of a dove. The dovetail is the strongest of jointings, because the tenon, or piece of wood which is put into the other, goes widening to the end, so that it cannot be drawn out again. Dovetails are either exposed or concealed; the latter being of two kinds, lapped and mitred. There is also a dovetail hinge, dovetail saw, dovetail file, and in Roman architecture an ornamented molding in the form of a dove's tail.

D'OVIDIO, dō-vēd'yō, Francesco, Italian philologist and critic: b. 1849. In 1876 he became professor of Romance philology at the University of Naples. With Ascoli and D'Ancona he holds a prominent place in the development of philological science and in the criticism of literature from the historical viewpoint.

DOW, or DOUW, Gerard, Dutch painter: b. Leyden, 7 April 1613; d. there, February 1675. He studied under Rembrandt and was distinguished for the excellence of his coloring and *chiaroscuro.* He surpassed his master in diligence and nothing can be more finished than his small pieces, which are so delicate that a magnifying-glass is necessary to see distinctly the work in them. His softest figures are full of life and he never neglected, in his representations, the almost invisible minutiæ of nature. He is regarded as the inventor of the ingenious mode of painting large pictures on a reduced scale, by covering the original with a frame, including a space divided into small quadrangular parts by means of threads and then transferring the parts into an equal number of similar divisions drawn on the canvas. He made use of the convex mirror to represent objects on a reduced scale. Among his best paintings are 'The Evening School,' a fine study in candle-light effect, now in the Rijks Museum, Amsterdam; 'Young Mother,' at The Hague; the 'Schoolmaster' and the 'Hermit' at Dresden. He numbers among his pupils Gabriel Metsu, Franz van Mieris, Schalken and Van Slingeland. Consult Van Dyke, 'Old Dutch and Flemish Masters' (New York 1895).

DOW, Lorenzo, American preacher: b. Coventry, Conn., 16 Oct. 1777; d. Georgetown, D. C., 2 Feb. 1834. Adopting the doctrines of the Methodists, 1796, he finally received a regular license to preach, and, in spite of contumely and rebuffs and ceaseless hardships and dangers of all kinds, persevered for nearly 40 years, with an enthusiasm which never relaxed and often with astonishing effect. In the course of his ministry he traveled over many parts of the United States and Canada, and in 1799 and again in 1805 visited England and Ireland, where his peculiar eloquence attracted much attention and on several occasions subjected him to persecution. Dow's eccentricity of manner and dress for a long time excited a prejudice against him, and in many parts of the country he was familiarly known as "crazy Dow." But to the class whom he most frequently addressed, his simple fervor, though coupled with illiterate phraseology, supplied the place of eloquence, and he seldom failed of having attentive hearers. His journal, containing the history of his life to his 40th year, together with some of his miscellaneous writings, was published in 1856. His wife was Peggy Dow, who was likewise well known for her religious eccentricities.

DOW, Neal, American temperance reformer: b. Portland, Me., 20 March 1804; d. 2 Oct. 1897. He was the author of the bill which prohibited the manufacture and sale of intoxicating liquors in the State of Maine, widely known as the "Maine Law." During the Civil War he was colonel of a Maine regiment and a brigadier-general of volunteers. In 1880 he was the Prohibitionist candidate for the Presidency and lectured widely on the subject.

DOWAGER, a widow with a dower. The word is commonly applied only to the widows of persons of the titled aristocracy.

DOWAGIAC, dō-wā'jăk, Mich., city in Cass County, on the Michigan Central Railroad, 35 miles southwest of Kalamazoo. It is the centre of a prosperous farming region and contains flour and lumber mills, a canning factory, a gashouse and a public library. There are manufactories of grain drills, stoves, gloves, furnaces and bait. Pop. 5,088.

DOWDEN, Edward, English literary critic and historian: b. Cork, Ireland, 3 May 1843; d. 4 April 1913. He was educated at Trinity College, Dublin, and from 1867 until his death held the professorship of English literature in that institution. He had a commanding position as a critic, especially in the field of Shakespearian criticism. His works include 'Shakspere: His Mind and Art' (1875); 'Poems' (1876); 'Shakspere Primer' (1877); 'Studies in Literature' (1878); 'Southey' (1880); 'Life of Shelley' (1886), the chief authority on the poet's life; 'Transcripts and Studies' (1888); 'Introduction to Shakspere' (1893); New Studies in Literature' (1895); 'The French Revolution and English Literature' (1897); 'History of French Literature' (1897); 'Puritan and Anglican' (1900); 'Robert Browning' (1904); 'Montaigne' (1905); 'Essays: Modern and Elizabethan' (1910).

DOWDEN, John, Scottish prelate: b. Cork, Ireland, 29 June 1840; d. 30 Jan. 1910. He is a brother of E. Dowden (q.v.). He was educated at Queen's College, Cork, and Trinity College, Dublin, and taking orders in the Scottish Episcopal Church, became bishop of Edinburgh in 1886. He has published 'The Annotated Scottish Communion Office'; 'The Celtic Church in Scotland'; 'History of the Theological Literature of the Church of England'; 'The Workmanship of the Prayer Book'; Further Studies in the Prayer Book'; 'The Mediæval Church in Scotland.'

DOWELL, Stephen, English author: b. Isle of Wight 1833; d. 1898. He was educated at Oxford, where he was graduated in 1855.

He studied law and in 1863 was appointed assistant solicitor to the Board of Inland Revenue, in which office he remained until 1896. He wrote several works on taxation, on which subject he was regarded as one of the greatest authorities in England, also legal and historical tracts and monographs. His long list includes 'The Income Tax Laws' (1874; 3d ed., 1890); 'A Sketch of the History of Taxes in England' (1876); 'A History of Taxation and Taxes in England, from the Earliest Times to the Present Day' (4 vols., 1885; 1888), the standard work on this subject.

DOWER. *In law,* the share or portion of the real estate of a deceased husband which passes to his wife for her natural life. At common law it consists of one-third of all the lands and tenements held in fee simple or fee tail by the husband at any time during coverture to which any issue of the marriage might have by possibility become heir. This right attached during the life of the husband and was not subject to his debts.

Dower is of ancient origin and has been subject to frequent change. In England it was known before the Norman conquest, and records show it to have been in vogue there in 1100, at the time of Henry I, and it was recognized in the Magna Charta of King John in 1215. It is known to Mohammedan law as well as to many other systems of law.

In England it was early found that the common-law dower generally served as an obstacle to the free alienation of real property, and this led to various methods of barring it, among them being uses to bar dower, which prevented purchasers from acquiring estates of inheritance. At the time of Henry VIII a statute was enacted to bar dower by the grant to the wife of a jointure before the marriage. This practice was superseded and the whole subject reformed by the statute of 1834, the terms of which permit the husband to defeat the dower, as by will or deed, thus leaving subject to dower only the real property of which he was seized at his death. Other changes were made by this act, including the extension of dower to embrace equitable estates of inheritance.

In the United States many jurisdictions follow the rules of the common law, at times somewhat modified by judicial interpretation, by statute or by constitutional limitations. However, in other jurisdictions some very valuable changes have been introduced. In a number of States dower has been superseded and a different interest substituted. By some of these statutory changes property acquired by the husband during coverture becomes community property, belonging jointly to husband and wife, vesting absolutely in the latter on the death of the husband. Statutes have been enacted in some States which make personalty, unlike the rule at common law, the subject of dower. Dower is not a contract right, but is founded upon public policy, the object being the support of the wife and the care and education of the younger children after the death of the father. Dower in real property is determined by the law of the place where such property is located, but dower in personal property is governed by the law of the domicile of the husband. Statutes abolishing the right of dower after it has vested by the death of the husband have been declared unconstitutional.

Dower at the present day may be barred by a fair antenuptial or postnuptial agreement in lieu of dower, by a reasonable separation agreement, by acceptance on the part of the wife of a devise or bequest in lieu of dower and by the wife's elopement and adultery. See HUSBAND AND WIFE.

DOWIE, John Alexander, American leader of a religious sect: b. Edinburgh, Scotland, 1847; d. Chicago, Ill., 9 March 1907. He studied for the ministry and held two pastorates in Sydney, Australia, but subsequently became an evangelist preacher. While in Australia he organized the International Divine Healing Association of which he became president. In its behalf he traveled in England and America and finally settled in Chicago in 1890. Here he built his wooden "tabernacle" in Woodlawn, which was opened in 1893, and attracted large crowds by his preaching and faith cures. He later organized the Christian Catholic Church in Zion, which grew rapidly, adding many auxiliary lines of work, such as a college for Zion preachers, a training school for deaconesses and a number of charitable institutions. Dowie had already established a publishing house, which became a part of the organization, and had full control of a bank, known as the Zion bank. He finally organized a land association and purchased a large tract of land on the shores of Lake Michigan, where he and his devotees built Zion City, the centre of all the numerous activities of the Christian Catholic Church; here he also established a lace industry. In this city he was practically dictator, forbade smoking, drinking, card playing, etc., and oversaw all branches of the work. He also preached frequently and gave special attention to the healing of the sick. In 1901 he made the claim of being "Elijah the Restorer." In 1903 he built the new tabernacle at Zion City, near Chicago. On 2 April 1906, he was suspended by his followers from the leadership and from membership in the church on charges of fraud, tyranny and polygamous tendencies. Consult Buckley, 'Dowie Analyzed and Classified'; *Century Magazine* Vol. LXIV, pp. 928–932); Napes, 'John Alexander Dowie and his Zions' (*Independent,* (Vol. LIII, pp. 1786–1791); Napes, 'John Alexander Dowie' (*Century Magazine,* Vol. LXIV, pp. 933–944).

DOWITCHER, dow'ich-ẽr, a sporting name for birds of the genus *Macrorhampus,* which are related to the snipes and are much hunted along the beaches of this country during the season. Two species, breeding far north, winter in South America and Mexico. The birds are from 10 to 12 inches long, with a bill nearly one-fourth the length of the body. The upper parts are dark while the under feathers are reddish.

DOWLAS, a kind of coarse linen, very commonly worn by the lower classes in the 16th century; also a strong calico made in imitation of the linen fabric. The name is said to be derived from Doullens, a town in the department of Somme, France. Before the introduction of machine-woven cotton cloth, dowlas was manufactured largely in Yorkshire, England, and in the south of Scotland.

DOWN, maritime county of Ireland, in the province of Ulster, area, 610,730 acres. It possesses good agricultural land, is rich in minerals and manufactures fine linens. Oats, wheat, potatoes and flax are the principal crops. The Mourne Mountains in the south reach to an altitude of nearly 2,800 feet in Slieve Donard. The county returns four members to the House of Commons. Capital, Downpatrick. Pop. 204,303; 31 per cent Roman Catholic.

DOWNCAST, in a mine with two or more shafts or openings, that opening through which fresh air from the surface enters the mine. Unless a fan or other contrivance is used to force the air down, the direction of the ventilating current changes with the temperature of the outside air.

DOWNERS GROVE, Ill., village in Dupage County, 20 miles west of Chicago, on the Chicago, Burlington and Quincy Railroad. It has a public library and manufactures furniture and tools. It has also large dairy and greenhouse interests. The waterworks and electric-lighting plant are owned by the village. Pop. 2,601.

DOWNES, William Howe, American journalist, art critic: b. Derby, Conn., 1 March 1854. He has been a staff writer on the Boston *Transcript* for many years. He has published 'Spanish Ways and By-ways'; 'The Tin Army of the Potomac'; 'Arcadian Days'; 'Twelve Great Artists'; 'Boston Painters and Paintings'; 'Life and Works of Winslow Homer' (1911), and written many papers on art matters for various magazines.

DOWNFALL, The ("LA DÉBÂCLE"), a novel of the Franco-Prussian War, by Emile Zola, published in 1892. The siege of Sedan forms the dramatic centre of the story, which is concerned chiefly with the friendship of Macquart and Levasseur, and the love of Macquart and Levasseur's sister Henriette.

DOWNING, SIR George, English soldier and political intriguer: b. Dublin about 1623; d. 1684. His uncle, Gov. John Winthrop, sent him to be educated at Harvard and Downing was graduated as a member of the first class there in 1642. After a few years he went to England and joined the Parliamentary army. He was a member of both Parliaments during the Protectorate, and was a leader in the movement to offer the crown to Cromwell. In 1655 he was sent to France to protest against the Vaudois massacre and two years later was appointed British resident at The Hague. He curried favor from the exiled royal family and after the Restoration was well received by them, being knighted in 1660, and made a baronet in 1663. He also served as Secretary of the Treasury and as Commissioner of Customs. His name is perpetuated in London in the well-known Downing street, where are situated most of the high offices of government, whence the British government is often popularly alluded to as "Downing Street."

DOWNING COLLEGE, one of the colleges of the University of Cambridge founded in 1800 and opened in 1821. Its founder was Sir George Downing, a Cambridgeshire gentleman, grandson of the politician after whom Downing street in London was named. The college is composed of a master, two professors (one of English law and one of medicine), six fellows and six scholars. There were 34 matriculations in 1913–14 and 19 in 1914–15.

DOWNING STREET, a short street in Whitehall (named after Sir George Downing, Secretary to the Treaury in 1667), London, England, where are the colonial and foreign offices, with the official residence since 1735 of the First Lord of the Treasury. Here Cabinet councils are held, hence the term is sometimes employed as a synonym for the British government.

DOWNINGTOWN, Pa., borough in Chester County, on the Pennsylvania and the Philadelphia and Reading railroads, 33 miles west of Philadelphia. It contains brickyards, knitting mills, machine shops and paper mills. Pop. 3,326.

DOWNPATRICK, or **DOWN** (Gael. *Dun,* fort), Ireland, a municipal borough and county-seat of the County Down, near the mouth of the Quayle, on Strangford Lough, 20 miles south of Belfast. Linen, muslins, leather, liquors and soap are manufactured. Vessels of 100 tons approach a quay about one mile below the town. It is a cathedral town. The present structure was restored in 1790 on the site of the church erected in 1412 and destroyed by fire in 1538. Downpatrick is probably the oldest town in Ulster. It was for a time the residence of the kings of Ulster and was a place of importance even before the arrival of Saint Patrick, who built the abbey of Saul nearby. By many it is thought that Saints Patrick, Brigid and Columbkill are buried here. Consult 'Ecclesiastical Associations or Downpatrick' (Belfast 1897).

DOWNS, a term applied to hillocks of sand cast up by the sea or wind along the sea coast; also to hilly tracts of grassy land suited for pasture; especially two parallel ranges of grassy hills in the south of England, the North Downs running east to west from Hants through Surrey and Kent to Dover, the South Downs in Hants and Sussex, terminating at Beachy Head. Botley Head (880 feet) is the highest summit in the North Downs, and Ditchling Beacon (858 feet) of the South Downs. Between the two ranges lies the valley called the Weald. The celebrated Southdown sheep pasture on these hills.

DOWNS, The, a celebrated roadstead for ships, eight miles long and six wide, along the southeast coast of Kent, in England, between the North and the South Foreland, the largest natural harbor of refuge on the English coast. It affords excellent anchorage with depths of from 25 to 70 feet and is sheltered by Goodwin Sands, a natural breakwater, with from one to four fathoms of water, but is open to the south. Deal, Dover and Sandown castles are its defense. An obstinate but indecisive sea-fight took place here in 1666 between the English and Dutch.

DOWRY, the property which a wife brings to her husband at her marriage; dot. In localities in which the civil law has been adopted, as Louisiana, it usually forms an important part of the law of property. It is also recognized by common law, and in England is known chiefly in connection with marriage settlements. Dowry is under the absolute control of the hus-

band, subject to the conditions that he cannot convey it if in the form of real estate and that he must use it for expenses of the family. While the title to dower is in the husband, he may take steps to prevent it being seized by his creditors. This term must be carefully distinguished from dower, with which it is sometimes confounded. See DOWER.

DOXOLOGY, an ascription of praise to the Almighty; in particular the Greater Doxology (*Gloria in excelsis,* Glory to God in the highest) and the Lesser Doxology (*Gloria Patri et Filio,* etc., Glory be to the Father and the Son; etc.). The Greater Doxology, as is seen, opens with the words of the evangelist Saint Luke when he recounts the circumstances attending the birth of Jesus at Bethlehem; the heavenly host chanting Glory to God in the highest, and on earth peace among men of good will. This Greater Doxology has a place in the Roman Catholic liturgy and in the communion service of the Anglican Church. Its introduction into the liturgy dates only from the time of Pope Symmachus (beginning of 6th century); previously it had been customary to recite it after the Mass. The Lesser Doxology had its origin apparently in the commission given to the Apostles (Matt. xxviii, 19) to teach all nations, baptizing them "in the name of the Father, Son, and Holy Spirit." An ancient form of this Doxology is "Glory to the Father in the Son," and that was considered to be consistent with orthodoxy till the Arians favored it as expressing their view of the relation of Jesus Christ to God the Father; then the orthodox rejected it and employed the other formula exclusively. In the Roman Catholic breviary at the end of each of the psalms of the daily office the *Gloria Patri,* etc., is always pronounced. The latter portion of this doxology, "as it was in the beginning, is now, and ever shall be. Amen," was appended as a protest against certain heretics of the 6th century who denied the Son's eternity. Another doxology called the Trisagion is also in use. It is the seraphic hymn from Isaiah. The Protestants sometimes apply the term to the hymn written by Bishop Thomas Ken. Its opening line is "Praise God from whom all blessings flow."

DOYEN, dwä'yăn', **Eugène Louis,** French surgeon: b. Rheims, Marne, 1859; d. Paris, 22 Nov. 1916. He became noted for his discoveries in surgery and his investigations of cancer. He introduced many innovations in surgical technique and in 1875 established a private clinic in Paris, which soon became a study centre for surgeons, both from France and other countries. His improvements were widely adopted, and Doyen thus became the leader of a new school of surgery. He made a special study of the treatment of cancer, and claimed to have isolated the germ of the disease, but other investigators have repudiated his claims. He long resisted bitter attacks made against his treatment, maintaining that cancer could be cured providing treatment was begun early enough. He published 'Traitement de Cancer' (1904); 'La malade et le médecin' (1906); 'Traité de thérapeutique chirurgicale et de technique opératoire' (1907); 'Le cancer' (1909).

DOYEN, dwä-yăn, **Gabriel François,** French painter: b. Paris 1726; d. Saint Petersburg, 5 June 1806. After study with Van Loo, he obtained the Grand Prix de Rome, and spent many years in Italy. His 'Triumph of Amphitrite' is in the Louvre, and an 'Adoration of the Magi' in the museum at Darmstadt. Other noted productions are in various churches, his most famous production, 'Miracle des Ardents,' painted in 1767, being in that of Saint Roch, Paris. At the invitation of Catharine II and Paul I, he went to Saint Petersburg, where he was employed in decorating the Winter Palace and the Old Hermitage.

DOYLE, Alexander, American sculptor: b. Steubenville, Ohio, January 1858. He was educated in Italy and in American public schools. He qualified for Cambridge University, but did not enter. He began the study of sculpture in the academies of Carrara and Florence, Italy, followed by several years' study at Rome and Paris. Among his notable works are the marble portrait and pedestal at the grave of John Howard Payne at Washington; the marble statues of Bishop Pinkney; Margaret Haughrey, Senator B. H. Hill and General Garfield; the marble portrait group of the two Cupples children at Saint Louis, Mo.; bronze statutes of Gen. A. S. Johnston and Robert E. Lee at New Orleans; Sergeant Jasper at Savannah, Ga.; Gen. Philip Schuyler for the National Revolutionary Monument, Saratoga; Gen. James B. Steedman, Toledo; Horace Greeley, New York; Mrs. Emma Willard, Troy, N. Y.; senators T. H. Benton, F. P. Blair and J. E. Kenna for the Capitol at Washington; Francis Scott Key at Frederick, Md.; the Soldiers' Monument at New Haven; the Soldiers' Monument, Montgomery, Ala. From 1899 to 1909 he was engaged in quarrying building stone in Indiana, resumed sculpture in 1909, and has since executed a statue of E. M. Stanton, Steubenville, Ohio, and the equestrian statue of Gen. G. T. Beauregard for the city of New Orleans.

DOYLE, Sir Arthur Conan, English novelist: b. Edinburgh, Scotland, 22 May 1859. He is a nephew of Richard Doyle (q.v.). He was educated at the Roman Catholic college at Stonyhurst, Lancashire, and at the University of Edinburgh. After practising as a physician at Southsea (1882–90), the success of several of his books induced him to give up the profession for that of literature. His works include 'A Study in Scarlet' (1887); 'Micah Clarke' (1888); 'The Sign of The Four' (1889); 'The White Company' (1890); 'The Adventures of Sherlock Holmes' (1891), a very popular series of detective stories; 'The Great Shadow' (1892); 'Memoirs of Sherlock Holmes' (1893); 'Round the Red Lamp' (1894); 'The Stark Munro Letters' (1895); 'Exploits of Brigadier Gerard' (1896); 'Rodney Stone' (1896); 'The Tragedy of the Korosko' (1898); 'Songs of Action' (1898); 'A Duet with an Occasional Chorus' (1899); 'The Green Flag' (1900); 'The Great Boer War' (1900); 'The Hound of the Baskervilles' (1902); 'Return of Sherlock Holmes' (1904); 'Sir Nigel' (1906); 'Through the Magic Door' (1908); 'Songs of the Road' (1911); 'The Lost World' (1912); 'The Poison Belt' (1913); 'The Valley of Fear' (1915); 'His Last Bow' (1917); 'The History of the Great War' (1917); 'The New Revelation' (1918). He has also written the plays, 'A Story of Waterloo' (1894); 'Halves' (1899), etc. He was knighted in 1902.

DOYLE, Sir Francis Hastings Charles, English poet: b. Nunappleton 1810; d. 8 June 1888. He was educated at Eton and Oxford, held the post of receiver-general and next of commissioner of customs, and in 1867 he was elected to the chair of poetry in Oxford University for the term of five years, being then elected for a second term of the same duration. He had already published 'Miscellaneous Verses' (1841); 'Two Destinies' (1844); (1866); and of the Guards and other Poems' (1866); and he subsequently published his Oxford lectures (1869 and 1877), and 'Reminiscences and Opinions 1813–85' (1886).

DOYLE, John Andrew, English historian: b. 14 May 1844; d. 5 Aug. 1907. He was educated at Eton and Balliol College, Oxford. He was an authority on the history of the English colonies in America, and wrote 'The American Colonies' (1869); 'A History of the United States' (1875); 'The English in America' (1882); 'The Puritan Colonies' (1887); 'The Middle Colonies' (1907); 'The Colonies under the House of Hanover' (1907).

DOYLE, Richard, English artist: b. London, September 1826; d. there, 11 Dec. 1883. His father, John Doyle (q.v.), the author of the celebrated "H. B." caricatures, initiated him into the mysteries of his art, and the young draughtsman became one of the founder-illustrators of *Punch,* the current design on the cover of which was invented by him. His sketches of the 'Manners and Customs of ye English' in that periodical, and the 'Bird's-eye Views of Society' in the early pages of the *Cornhill Magazine* illustrate the mode of life and manners of London men and women of his time with rare felicity and fidelity. In 1850 he severed his connection with *Punch* on account of its frequent attacks on the Pope and Doyle's coreligionists and Roman Catholics. His water colors are equally well known. Among them may be mentioned 'Under the Dock Leaves' (British Museum); and 'The Triumphant Entry,' a fairy pageant (National Gallery, Dublin).

DOYLESTOWN, Pa., borough, county-seat of Bucks County, 34 miles north of Philadelphia, the terminus of a branch of the Philadelphia and Reading Railway. It is in a fertile farming section and has a thriving local trade. It has a courthouse, public library, an academy, a female seminary, graded schools and handsome churches and private residences. The town is lighted by gas and electrcity. Its chief manufactures are wagons, carriages and farm implements, flour, lumber, soap, woolens and cabinet ware, hosiery, silk, worsted mills, a foundry, creamery, tannery and clay-works. Doylestown has a national bank, a trust company and daily and weekly papers. It is a popular residence town and has a large summer population. Pop. 3,304.

DOZY, dō'zē', Reinhart Pieter Anne, Dutch Orientalist and historian, of French Huguenot descent: b. Leyden, 21 Feb. 1820; d. there, 29 April 1883. He obtained the degree of doctor from the University of Leyden in 1844. The following six years were spent in study and writing, and in preparing a catalogue of the Oriental manuscripts in the university library. He was made an extraordinary professor of history in 1850, and full professor in 1857. He was considered one of the most learned and critical scholars of Arabic of his time; was an authority upon Oriental language and history, and spoke and wrote almost all of the European languages with facility. He is known chiefly by his great work, 'Histoire des Mussulmans d'Espagne, jusqu'à la conquête de l'Andalousie par les Almoravides, 711–1110' (1861, 2d ed., 1881), and its supplementary volume, 'Recherches sur l'histoire et la littérature de l'Espagne pendant le moyen âge' (1849, 2d ed., 1860, 3d ed., 1881), which remain the standard works upon this period of Spanish history, and by his 'Supplément aux dictionnaires arabes' (1877–81). Other important works are his 'Dictionnaire detaillé de noms des vêtements chez les Arabes' (1845); 'Scriptorum Arabum loci de Abbaditis' (1846); 'Commentaire historique sur le poème d'Ibn Abdoun par Ibn Badroun' (1846); History of the Almohades' (1847); 'Histoire de l'Afrique et de l'Espagne' (1848); 'Al Makkari, analectes sur l'histoire et la litterature des Arabes d'Espagne' (1855–61); 'Het Islamisme' (1863); and 'De Israëlieten te Mekka' (1864).

DRAA, drä, or **WADY DRAA,** a river of Morocco, rising in the Atlas Mountains and flowing southward till it penetrates the Anti-Atlas at Shagerun. Beyond this point it flows sluggishly through the desert, at first south and then west, forming the shallow lagoon El Debaia.

DRACÆNA, drā-sē'na, a genus of tropical plants of the family *Liliaceæ.* The species are characterized by woody stems, which bear numerous sword-shaped leaves crowded together near the summit, and greenish-white, or yellowish, flowers in panicles or heads. A few of the species are cultivated in hothouses, for their attractively colored foliage. The most notable species is probably *D. draco,* the dragon-tree of the Canary Islands, which attains a height of from 30 to 50 feet, though in one notable specimen, at Teneriffe, the height was 70 feet, and the diameter 15 feet. This was when Humbolt visited the island. When this tree was destroyed by a storm in 1868 it was estimated to be about 6,000 years old. It was not only an object of worship, but its sanctuary was inside its own trunk.

DRACHENFELS, drä'hĕn-fĕlz, "the castled crag of Drachenfels," as Byron calls it, one of the hills known as the Siebengebirge, in the government of Cologne, in Rhenish Prussia, about eight miles southeast of Bonn. It is the most remarkable of the group, which are all evidently volcanic; rises about 900 feet above the Rhine, and is crowned by the old castle of Drachenfels, commanding a magnificent view. It takes its name (Dragon Rock) from the legend of a dragon which occupied a cavern in it, and was slain by Siegfried, the hero of the Nibelungenlied.

DRACHMA, drăk'ma, the unit of weight and of money among the ancient Greeks, both as a weight and a coin contained six oboloi, and was itself the one hundredth part of a mina, and the six thousandth part of a talent. The weight of the Attic drachma was 67.5 grains English troy weight, and the Attic talent 70.3 pounds. There were several other kinds of drachma and

talent in use: those of Ægina were the heaviest. Whenever no particular kind is designated, the Attic talent is meant. The drachma was the principal Greek coin. It was of silver, and was divided, like the weight, into six oboloi (silver). The tetradrachma (of four drachmas) was called the *stater,* but other coins also bore this name. These coins differed much in value in the different states of Greece and at different periods. The Attic drachma and stater occur most frequently. The value of the former may be stated as 17 cents, of the latter at about 80 cents. The drachma was regarded as equivalent to the Roman denarius. Besides these silver coins there were also the stater (or didrachm) of gold, equal in value to about $5.63. In the time of Solon a sheep could be bought for one drachma, an ox for five. In the time of Demosthenes a fat ox cost 80 drachmas, a lamb 10. The drachma has an important position in the coinage and currency of modern Greece, being the standard unit of reckoning, and a silver coin equivalent to the French franc.

DRACHMAN, Bernard, American rabbi: b. New York, 27 June 1861. He was educated at Columbia University and the University of Breslau and has been professor of biblical exegesis and Hebrew philosophy in the Jewish Theological Seminary of New York from 1887, and rabbi of the congregation Zichron Ephraim in that city from 1889. From 1902 to 1908 he was professor of Bible and Rabbinical codes. In 1909 he became rabbi of the congregation Ohab Zedek. He is a staunch supporter of orthodox Judaism and is the author of 'The Place and Importance of Jehuda Hajjug in the History of Hebrew Grammar' (1885); 'From the Heart of Israel: Jewish Tales and Types' (1905); a translation into English (1899) of S. R. Hirsch's German work 'The 19 Lectures of Ben Uziel.'

DRACHMANN, drä'män, **Holger Henrik Herholdt,** Danish poet, painter and novelist: b. Copenhagen, 9 Oct. 1846; d. 14 Jan. 1908. He published about 40 volumes, in narrative and lyric poetry, drama and prose fiction. In poetry as in painting his *forte* was the sea, and he excels in descriptions of seafaring folk. Radical in his youth, he was intensely nationalist in his later years. He published five volumes of poems and was also a notable playwright. His novels include 'Condemned' (1890); 'Once Upon a Time'; 'Paul and Virginia' (1879); and 'Sea Tales.' Drachmann visited the United States in 1898.

DRACO, drā'kō, Athenian legislator: fl. about 621 B.C. His name has become proverbial for severity, and his laws were hence said to have been written in blood, not ink. It seems, however, probable that Draco only put in writing the laws of his time and nation, which punished petty theft, and even idleness, no less severely than the robber of the temples and the murderer. Subsequently years afterward, Solon was commissioned to draw up a new code. Tradition relates that Draco, on his appearance in the theatre at Ægina, was suffocated by an enthusiastic audience, who according to their custom, threw their garments and caps upon him.

DRACO, an ancient northern constellation. The Gamma Draconis, a bright star nearly in the solstitial colure, was used in determining the coefficient of aberration of the fixed stars.

DRACOCEPHALUM, a genus of odoriferous annual or perennial herbs, of the mint family (*Menthaceæ*), numbering about 40 species, natives of the northern hemisphere. The name is Greek for dragonhead, which is a reference to the resemblance of the flowers to the head of the dragons of myth. Of the species comprised in the genus, but two are American. American Dragonhead (*D. parviflorum*) is an annual, one to two feet high, with light blue flowers, common in stony soil from Ontario, through northern New York, to Minnesota and Alaska, and in the Rocky Mountain region to Mexico. The other species is found only in a restricted area in Nebraska and northern Mexico. It was introduced from Europe and is listed as Moldavian dragonhead.

DRAFT, a written order for the payment of a sum of money addressed to some person who holds money in trust, or who acts in the capacity of agent or servant of the drawer. Documents of this kind often pass between one department of a bank or mercantile house and some other department, and are distinguished from bills of exchange and checks, in not being drawn upon a debtor. One reason for using them is the convenience in keeping accounts and having vouchers for payments. See BANKS AND BANKING — COMMERCIAL PAPER.

DRAFT RIOTS, in New York, July 1863, were serious disturbances caused by the military conscription or drafts (q.v.) of that year, which met with a storm of denunciation from Democratic leaders and followers alike. The former proclaimed it unconstitutional, because military service was due only to the State; dangerous, as liable to absorb all the State militia and civil officials into the Federal service; and partisan in execution, the quotas having been gerrymandered to throw an enormous disproportion on the Democratic districts. This last was true, but was the work of subordinates, and was corrected by the War Department on protest. The rank and file execrated it as a class measure, shifting the burden from the rich, to whom $300 was a trifle, to the poor, who could pay only with their blood, and were least able to leave their families. The only answers were the nation's need, the law of nature that all burdens fall thus on the poor, and the government's wages, bounties and pensions which strained it to relieve distress. But the legal and party arguments reinforced the class hatred and anti-war prejudice, and Gov. Horatio Seymour, the head of the Democratic party, sent his adjutant-general to Washington about 10 July to urge the postponement of the draft, on the ground of this popular excitement.

The drafting began, however, on Saturday morning, 11 July, at each provost-marshal's or assistant's office; which in the ninth district, a Democratic stronghold, was at Third Avenue and 46th street. The method was to place the enrolled names in a wheel and turn it, the first names coming out up to the assigned quota being the conscripts. A large crowd assembled, but made no disturbance; and the names drawn were published in the Sunday papers. Many of the poorer ones, incited and organized by political leaders, met secretly and formed associations

to resist; and on Monday morning, parties went around the shops compelling workmen to leave their tasks and join the procession. The drawing was resumed at 10 A.M.; in a few minutes several paving-stones, one after another, were hurled through the windows into the midst of the crowd, smashing the furniture; and in another moment the mob broke in the door, wrecked everything inside but the wheel, beat one of the deputies into insensibility, and set fire to the building, though it was inhabited above. The whole block was shortly in flames; and when the firemen arrived, the hydrants were denied them till the conflagration was past help. The militia were nearly all in Pennsylvania, where Gettysburg had lately been fought, and the few garrison regulars and marines were under different commands; so that the Federal General Wool, the State General Sanford and Mayor Opdyke held separate authority with no deciding power. The mob increased, and began wreaking vengeance on political opponents and their property, burning and pillaging; and thieves and toughs, seeing their opportunity, flocked out and joined. Fifty marines, sent to disperse the 46th street mob, fired blank cartridges, and were instantly routed and chased far along the streets by the rioters, many of them women and children. This changed the mob's attitude from defense to aggression; a squad of police was set upon and one killed. Then their wrath was turned on the negroes, as the cause of the "Black Republican War." These were beaten and stoned to death, and hanged to lamp-posts; hotels and restaurants having colored servants were invaded in search of them, and the movables smashed or stolen. In the afternoon the Colored Half-Orphan Asylum, with 700 to 800 children and nurses, was broken into, gutted and set on fire, the inmates being driven into the street while the women of the mob carried off the furniture. The armory on Second Avenue was broken open with stones and sledge-hammers to secure the arms, the police who bravely defended it driven out, and it was fired. All business and trade were suspended. In the lower part of the city the office of the *Tribune*, the chief Republican paper, edited by the abolitionist, Horace Greeley, was attacked and about to be set on fire, but the police drove out the rioters. The entire block on Broadway which held the draft office was burned, with the provost-marshal's and the postmaster's private residences, a station-house, a hotel whose proprietor refused liquor to the mob, and other dwellings; and other houses were burned in the upper part. All that day and night the city was protected only by the police, many of whom lost their lives. At midnight a heavy rain dispersed the rioters for the time.

Tuesday was far worse, though the forces of order had begun to gather. The mobs too had swollen so that an army was needed; when bands were dispersed by the military, they gathered elsewhere and continued murder and depredation. Twenty negroes probably had been murdered Monday; far more perished Tuesday, and whole negro neighborhoods were burned out. Lieutenant Wood with 150 regulars from Fort Lafayette fired ball cartridge into a mob, killed a dozen and broke it up, but no officer could be ubiquitous. Colonel O'Brien, who had dispersed a mob, sprained his ankle and stepped into a drug store; ordered out by the terrified proprietor, the mob murdered him, and dragged his carcass up and down the street, mutilating and tramping on it. Governor Seymour issued a proclamation summoning the rioters to disperse, but it was so insufficient that he was forced to issue another putting the city under martial law. Meantime the Secretary of War had ordered home the militia regiments in Pennsylvania, and they began to arrive on Wednesday; the draft was announced as temporarily suspended; and the mob was so thoroughly beaten and cowed on Wednesday afternoon that cavalry regiments paraded the city at night without meeting any resistance. Isolated gangs prowled about even on Thursday, but they were mere criminals and soon slunk away. The property-holders had formed associations for self-protection, and the danger was mainly at an end by Thursday morning. The losses of these four days were never known. The bills of mortality for the week were 450 above the average; 90 deaths from gunshot wounds were reported; and it was said that many rioters were secretly buried by their friends. Claims for property damage were filed to over $2,500,000; though heavily scaled, something like $1,500,000 was paid. The draft was resumed on 19 August, and ended on the 28th. Consult 'Official Record (XXVII, Pt. 2, 1889); Fry's 'New York and the Conscription of 1863' (1885); Greeley's 'American Conflict' (Vol. II, 1866).

DRAFTS, or MILITARY CONSCRIPTIONS, in the history of the United States, aside from the drafts of the Confederate States of 18 July 1863, and the sweeping one of 17 Feb. 1864, which was in action all through the latter part of the Civil War—are those of 1814, 1863 and 1917. In the Revolution, the regular armies of the United States were recruited by drafts from the State militias (see CONTINENTALS), but these transfers were made by requisitions on the States, who furnished and officered their quotas in such bodies as they chose. The Constitution gave Congress the twofold power to "raise armies," and to "organize and arm the militia." Knox in 1790, and Jefferson in several annual messages urged a thorough plan for the latter, classifying the militia independently of the State organizations, and drafting one from each section as needed; but jealousy of the States' rights over the militia was too strong. In the War of 1812, requisition was made on States for militia to replace coast garrisons, denuded for invasion of Canada, but Connecticut and Massachusetts refused on the ground that as this country was not invaded, there was no constitutional right to summon the militia. When this excuse failed, others were found; in 1813 a militia organization bill passed the House, but failed in the Senate. In 1814 the increasing exigencies forced a bill through Congress (Senate 10 Nov.; House 9 Dec.), on suggestion of the New York and Virginia legislatures; but even its Democratic supporters doubted its being either constitutional or useful, and the House loaded it with an amendment on which the Senate disagreed, as doubtless intended. The war ended shortly after. In the Civil War, volunteering filled the armies during the first two years, the quotas being apportioned by congressional dis-

tricts; then the numbers grew scant, and on 3 March 1863 the "Conscription Bill" passed. The intent was the old plan of militia classification and draft, but the Democrats held it unconstitutional, and their arguments were unanswerable. The Republicans therefore fell back on the broad power to "raise armies," as implying the right to fix the method of so doing; this in turn was incontrovertible, and upheld by the Supreme Court. The State militias were ignored. All able-bodied citizens between 18 and 45 were summoned to the national defense, and were to be enrolled from 1 April on by the provost-marshals; quotas under future calls not filled by volunteers after a certain period were to be made good by lot from the enrolment; conscripts could furnish substitutes or buy exemption for $300; all persons refusing obedience to be punishable as deserters. Early in May 300,000 more troops were called for; many Eastern cities were already in arrears, and the poorer classes, especially those politically hostile to the war, grew very bitter at the real hardships and the real and alleged unfairness of the conscription. The invasion of Pennsylvania by Lee had drawn the Northern State militia thither in June and early July, and the mob in several places undertook to resist the draft. The police easily put down the rising except in New York, where the great numbers of the rioters, reinforced by the criminal classes, gave the city into their hands for two days, 13 and 14 July, and they were not suppressed till the 15th. (See DRAFT RIOTS). The drafts interrupted by these disorders were resumed and carried through. But their chief value was in goading the districts into filling the quotas by volunteers; however legal, they were incredibly scanty of direct results. The commutations were toward a third of the whole, the exemptions nearly a half, and the number held and their substitutes together were but a sixth to a fifth. Also, many of the substitutes turned deserters or "bounty-jumpers." It has been estimated that of over 3,000,000 enrolled, less than 100,000 men were obtained by the drafts.

In 1917, upon the entry of the United States into the European War, it was decided by the Administration to have recourse to a draft for the recruitment of the army. The bill authorizing this was passed on the 28th of April, with remarkably little opposition. The draft applied to all citizens and those with first papers between 21 and 31, inclusive. No exemption by purchase nor by substitute was allowed, and clergymen, divinity students, and those belonging to recognized sects forbidding military service were exempted. Registration took place on the 5th of June. There was very little resistance shown toward the draft, and the resistance which occurred was readily controlled. The order of service was determined by lot. The men began going to camp in October. In December those who had registered were made to fill out questionnaires that they might be more readily classified for service. Married men were granted the privilege of being drafted later than single men, and other similar delays were allowed for those concerned in necessary occupations. Throughout 1918 other great movements of men continued toward the camps. On the whole, the so-called National army recruited by the draft was a marked success in contrast to the unfortunate experiences of Civil War times. See CONSCRIPTION.

DRAGE, drāj, **Geoffrey,** English publicist: b. 1860. He was educated at Eton and Oxford and is a barrister of Lincoln's Inn and the Middle Temple, but has never practised. He was Secretary of the Royal Commission on Labor, (1891–94), and Unionist M.P. for Derby (1895–1900). He has published 'Criminal Code of German Empire' (1885); 'Cyril,' a novel (1889); 'Eton and the Empire' (1890); 'Foreign Reports of Royal Commission on Labor'; 'Eton and the Labor Question' (1894); 'The Unemployed' (1894); 'The Aged Poor' (1895); 'The Labor Problem' (1896); 'Trade Unions' (1905); 'The Imperial Organization of Trade' (1911); 'The State and the Poor' (1914); etc.

DRAGO, Luis María, Argentine diplomat, jurist, and publicist; b. Buenos Aires, 6 May 1859, and educated at the university in that city. He entered the profession of the law, became a judge in the national capital, and Minister for Foreign Affairs under President Roca. As Foreign Minister, he sent to the Argentine Minister in Washington (1902) instructions that embodied a principle, advocated in his own country and through the publications of Carlos Calvo (q.v.), which became known as the Drago Doctrine (q.v.). He was one of the Argentine delegates to the second peace conference; one of the arbitrators nominated by agreement between the United States and Great Britain for the hearing of differences in regard to the North Atlantic coast fisheries; member of the Permanent Court of Arbitration at The Hague. His works are 'La Literatura del slang'; 'La Idea del Derecho' (with D. Matrenzo); 'Colección de Fallos en Materia Civil y Comercial'; 'Los Hombres de Presa'; 'Cobro Coercitivo de Deudas Publicas'; 'La República Argentina: il case de Venezuela'; 'Les Emprunts d'Etat et leur Relations avec la Politique Internationale.'

DRAGO DOCTRINE, the principle laid down by a renowned Latin-American publicist, Luis María Drago (q.v.), in line with the teachings of his predecessor Carlos Calvo (q.v.), the meaning of which was and is substantially that "no state ought to be invaded for the collection of money claims" (Albert Bushnell Hart, 'Cyclopedia of American Government,' Vol. II, 'Monroe Doctrine' — 'The Drago Doctrine.' The Drago Doctrine, which was pressed upon the United States in the Pan-American Congresses of 1890, 1901, 1906 and 1910, received President Roosevelt's formal adherence; and, as Professor Hart says, "European nations reasonably look to the United States to find some way of securing reparation of their injuries and claims, so long as this country [the United States] holds it as part of the Monroe Doctrine that such reparation may not be directly sought. Such a use of the Monroe Doctrine would make the United States responsible for the good behavior of all the Latin-American countries. This question was much accented from 1911 to 1914 by revolutions in Mexico, involving the property, lives and interests of citizens of many countries, and the United States, by fending off other powers, made itself responsible for securing good order in Mexico."

DRAGOMAN, the general name given in Levant countries to an interpreter, or to a guide to foreigners. The dragoman is, however, much more than the Italian *cicerone,* or the French *commissionaire* or *valet de place.* In Syria, for example, he is a contractor for the management of expeditions, and undertakes to solve all the difficulties that arise between the traveler and the natives. The dragomans attached to embassies have special privileges. Student dragomans is a term sometimes given to student interpreters preparing for the British consular service in the Orient. The dragoman to the Porte, through whom diplomatic negotations with foreign powers were formerly carried on, used to be a very important dignitary.

DRAGOMANOV, drä'gō-mä'nôv, **Mikhail Petrovitch,** Russian author: b. Hadyatch, Poltava, 1841; d. 1895. In 1865 he became lecturer at the University of Kiev and was professor of general history there until 1876. He criticized the educational system introduced by Dmitri Tolstoi because of its being based on German classic models. Dragomanov refused to resign when his Ukrainophil activity brought him into conflict with the authorities. Alexander II appointed a commission which found him guilty and he was forbidden to reside in Little Russia or to engage in literary pursuits. Other measures of repression were at the same time enforced against the Ukrainians. Dragomanov went to Geneva, and in 1888 was appointed professor of history at the University of Sofia, Bulgaria. He stood forth in his generation as the foe of autocracy and oppression in every form; he advocated a complete reorganization of Russia along the line of federated states, with every nationality securing equal representation. His literary and historical works deal mainly with Little Russia. He published 'The Historical Songs of Little Russia,' with Professor Antonovitch (1874); 'The Question of Little Russian Literature' (1876); a popular series of pamphlets in the dialect of Little Russia; *Homada (the Commune),* a periodical (1878–82); 'Le tyrannicide en Russie' (Geneva 1876); 'La Pologne historique et la démocratie moscovite' (1881); 'The Political Songs in the Ukrainian Language in the Eighteenth and Nineteenth Centuries' (London 1883–85).

DRAGOMIROV, drä'gō-mē'rôv, **Mikhail Ivanovitch,** Russian army officer: b. 1830; d. 1905. He was educated at the War Academy in Saint Petersburg, and abroad, and in 1858 was appointed professor of tactics there. His lectures attracted considerable attention. He participated as military attaché in the Austro-Prussian War and in 1868 was made major-general and chief of the general staff at Kiev. He commanded the Russian advance guard in the war with Turkey in 1877–78, and distinguished himself at the crossing of the Danube at Sistova. He was wounded in the fighting at the Shipka Pass and was obliged to retire from active service. Later he was appointed director of the War Academy, where his influence on military training and organization was wholesome and widely extended. He wrote 'Lectures on Tactics' (1864); 'The Austro-Prussian War' (1866); 'Discipline and Subordination' (1894); 'A Study of the Novel "War and Peace"' (1895); 'The French Soldier' (1897); 'War is an Inevitable Evil' (1897); 'Joan of Arc' (1898); 'Duels' (1900).

DRAGON, a genus of arboreal lizards, of which the most familiar is *Draco volans.* The genus is especially remarkable for the extension of the skin of the sides on the prolonged posterior ribs. A parachute is thus formed which enables the dragon to take rapid swoops from branch to branch. The tail is very long; the skin of the throat forms a loose wattle; the colors are particularly brilliant. There are several species inhabitants of the East Indies, not including Ceylon. The term dragon has also been applied in modern times to a large lizard (*Thorictis dracæna*) found in Brazil and Guiana. It attains a length of three feet, most of which goes to the tail. *Tejus* and *Ameiva* are allied genera.

DRAGON. This mythological monster is often confused with the equally fabulous griffin. A distinguishing feature is the characteristic bat wings (with ribs and web) of the former while the griffin has feathered bird wings. With its supposed terrible fighting powers — having scaled armor and breathing flames — it is not surprising that the ancient Greeks and Romans utilized its figure as expressive of power. The Roman armies termed their standard bearers *draconarius,* because they carried this animal as an ensign. But Meyrick says Trajan adopted it from the Dacians, after their defeat. The Grecian dragon (termed *hydra*) was specially formidable from its having seven ferocious heads. The dragon was a Celtic symbol of sovereignty and figured in the English standard from pagan times to the reign of Henry VII. It is found as a device on some of the knights' shields in the Bayeux tapestry. In the early days of firearms (17th century) a certain short musket which was hooked to a swivel attached to the soldier's belt was so termed, because a dragon's head formed the muzzle. Such soldiers were termed *dragoons.* In mediæval alchemy the dragon was the emblem of Mercury, hence this beast figured among the signs found on the chemist's and apothecary's drug-pots. A stuffed crocodile is seen hanging from the ceiling of the drug shops in old pictures; it did service for the fictitious reptile. In astronomy this animal (as *Draco*) figures in the northern constellation.

In Byzantine art the dragon was the personification of evil — public calamity, such as pest, famine, etc. In Christian archæology the dragon has a very active presence. The great dragon, Gargouille, lived in the Seine and ravaged Rouen. It was slain by Saint Romulus in the 7th century. The French word gargouille means waterspout, hence the spouts draining off the water from the walls of churches and large edifices were usually in the decorative form of an open-mouthed dragon. Various races and countries have their special dragon and dragon-slayer legends. The French dragon of Languedoc, Tarasque-gargouille, was slain by Saint Martha, and the city of Tarascon is said to have derived its name from the event. The most favored dragon-slaying legend of the artists, past and present, is that of Saint George (the English patron saint) slaying the dragon. Memling, Tintoretto, Pisanello, Domenichino, depicted this subject (paintings

are in the London National Gallery), and it is found carved and in stained glass in a great number of the old churches. Another similar picture frequently seen is that of the conflict between Saint Michael and the dragon..

The fact of the ancient origination of this subject is shown in the discovery of the picture of conflict on stone slabs in Persepolis and Nineveh, and the Greek mythology had its Perseus and Andromeda.

In Chinese legend the dragon (*lung*) figures very prominently. The Celestials say there are three dragons, one (*lung*) in the sky, one (*li*) in the sea, one (*kiau*) in the marshes. Lung is the most important of these, and is described as having the head of a camel, the horns of a deer, the eyes of a rabbit, ears of a cow, neck of a snake, belly of a frog, scales of a carp, claws of a hawk and palm of a tiger. This marvelous creation has whiskers on each side of its mouth, also a beard (in which is often depicted a bright pearl). The sea-dragon appears in waterspouts and the Chinese fishermen worship him in fear (Williams). Mayer accounts for four Chinese dragons. "(1) The Celestial dragon, which guards the mansions of the gods and supports them so they do not fall. (2) The Spiritual Dragon, which causes the winds to blow and produces rain for the benefit of mankind. (3) The Dragon of the Earth, that marks out the courses of rivers and streams. (4) The Dragon of the Hidden Treasures, which watches over the wealth concealed from mortals." A dragon is the emblem of the Emperor of China, and has five claws (others four), and is forbidden to be represented except on imperial goods. As the dragon is one of the chief decorative features of Chinese arts, this latter fact is of value to connoisseurs, since the presence of the five-clawed dragon on bronzes, pottery, tapestry, etc., is proof of the article having been made for the Imperial court. In the Chinese zodiac the dragon is sign for the month of March.

The Japanese dragon (*rio* or *tatsu*) while, probably, derived from the Chinese, differs from it. It has but three claws, one of which usually grasps the "perfect crystal ball," or a pearl. The Japanese dragon is supposed to have the power of rendering itself invisible; it may shrink to silkworm dimensions or increase its size till the universe is covered with its presence. Pictorially illustrated in multitudes of Japanese decorative work the *tatsu* is seen floating among the clouds or rising from stormy waves on the ocean. The Persian dragon has cloven hoofs.

CLEMENT W. COUMBE.

DRAGON, *in astronomy,* one of the ancient northern constellations, in Latin, *Draco.* The figure is that of a serpent with several small coils. It appears at a very ancient date to have had wings in the space now occupied by the Little Bear. Fable says that Juno translated to the heavens the dragon which kept the golden apples in the Garden of the Hesperides, and which was slain by Hercules. See HESPERIDES.

In Zoology, a lizard of the oriental genus *Draco.*

DRAGON-FLY, an order of insects, the Odonata, allied the may-flies and ephemerids, with long, slender bodies, very large mobile heads, immense eyes, short antennæ, and two pairs of long, nearly equal wings of a firm and glossy texture, and closely netted with many veins. The mandibles are powerful, the mouth-parts being so fused and solidified as to form a most effective trap for catching the small insects upon which dragon-flies feed. The prothorax is small, the meta-thorax and meso-thorax large, and the meso-thorax slopes over the meta-thorax, by which arrangement the spinous legs are thrust forward, so that they project under the head. These legs are unfitted, and are never used, for walking, but as instruments for catching and holding prey or for clinging to plants. The hind body is proportionately longer than in any other group of insects; it has 10 evident segments, the hindmost carrying a pair of stiff unjointed cercopods. The male genital armor is situated on the second abdominal segment — a position unknown in any other insect; and the intromittent organs are separate from the ejaculatory ducts, the latter being near the extremity of the abdomen. "Therefore," as Howard explains, "before copulation the male curves his abdomen around beneath, so that the ninth segment of the abdomen is brought into contact with the second, thus transferring the fertilizing fluid to the intromittent organ. The tip of the abdomen of the female is bent around and joins with the underside of the second segment of the male's abdomen, the male frequently grasping the female around the neck with certain appendages at the extremity of his abdomen. This complicated embrace commonly observable where these flies are numerous in midsummer, once obtained is likely to be held during the whole process of egg-laying, even in many cases when the deposition takes place under water.

Dragon-flies are semi-aquatic in all their life and habits. The eggs are laid in the stems of submerged plants by some species, which are provided with an instrument for cutting through the bark, each egg being pushed into the cutting as the female moves down the stem. As a rule, however, the eggs are dropped into the water, or washed off by dipping the tip of the abdomen. The number of eggs laid is large, exceeding 100,000 in the case of many libellulids.

When the eggs hatch the young immediately begin a life of activity and depredation. Molts follow one another rapidly, and the first larval form soon changes into a "nymph," a form equivalent to the pupa stage of other insects, but differing in the fact that activity continues. These young remain under water, have short, broad hinder bodies, walking legs, feelers, and breathe by means of "rectal gills." They prey upon everything edible, including their own weaker brethren. To assist them in doing this the mouth-parts are modified into an insect-catching trap, forming an innocent-looking mask, within which are concealed grasping organs, ready to be shot out when an unsuspecting little animal creeps too near and the mask is suddenly lifted. When the broad and flattened nymph has become full-grown it crawls out of the water upon some warm rock, where presently its skin splits open and the adult dragon-fly emerges. These changes are easily studied by breeding dragon-flies in an aquarium.

The voracity of dragon-flies is notorious. They seize and devour all sorts of insects, including smaller species of their own race, and sometimes moths, butterflies and wasps. Flies

form their principal fare, however, and they consume vast quantities of house-flies and mosquitoes, but their service in killing the latter pests is mainly done during the larval stages. They abound, in midsummer, in most parts of the world, and sometimes appear in enormous swarms, millions moving across the country in company; such swarms are the result of various local conditions and are not migrations, properly speaking. The great beauty which most of the species have, glittering in metallic hues and skimming through the sunshine on brilliant, gauzy wings, has made them objects of universal admiration; but this admiration is strangely coupled with a popular fear and superstition toward them. Thus they are commonly known among American children as "devil's darning-needles," and are accused of an intention to sew up the ears of bad boys, or work mischief in the hair of naughty girls. The negroes of the Southern States call them "snake-doctors," and say they feed and nurse ailing serpents. In Great Britain, they are known as "horse-stingers," "flying-adders" or "penny-adders," and are believed to carry a poisonous sting in their tails. All these superstitions are calumnies upon a harmless and beneficial insect.

About 2,000 species of dragon-flies have been described of which an eighth are peculiar to the United States. The order contains two well-marked groups: the Libellulidæ, or dragon-flies proper, and the Agrionidæ, demoiselles or damsel-flies, distinguished broadly by the fact that in the former the front wings are dissimilar, and are held horizontally in repose; while in the latter the wings are alike and are held vertically when the insect rests. Another distinguishing feature is the fact that in the Libellulidæ the eyes are sessile, sometimes meeting on the top of the head, while in the Agrionidæ the eyes are constricted at the base and peduncled. An important subdivision of the Libellulidæ, regarded by some as a separate family, is the Æschnidæ, which is characterized by the fact that the eyes touch on the top of the head. To this group belong many of the largest and most gaudy dragon-flies.

An excellent illustrated account of North American dragon-flies will be found in L. O. Howard's 'The Insect Book (1901), which contains further references. For British species consult Lucas' 'Handbook of British Dragon-flies' (1899).

DRAGON ROOT, or **GREEN DRAGON** (*Arisæma dracontium*), a plant of the *Arum* family, occurring in wet woods and along streams, from Maine west to Minnesota and southward to Florida and Texas. The spathe envelops the greenish spadix, the upper part of which tapers into a long, slender appendage, extending beyond the apex of the spathe, sometimes as much as six inches. The corm contains an acrid or pungent sap, which is supposed to possess curative properties, and is much used as a household medicine in the region of its growth.

DRAGONET, the common name of certain fishes of the family *Gobiidæ*. The gemmeous dragonet (*Callionymus lura*), a beautiful fish with a large head and a smooth tapering body, is found in the British seas. See GOBY.

DRAGONNADES, drăg-ō-nādz', the name given to the persecutions directed against the Protestants chiefly in the south of France, during the reign of Louis XIV. They commenced in Poitou, and their nature may be understood from a letter from Louvois, the French Minister, to Marillac, the governor of the province. It is dated 18 March 1681, and says, *inter alia*, that his majesty wishes that the greatest number of troopers and officers be billetted on the Protestants, and that when a just division makes them liable only to 10 they may be saddled with 20. Marillac, thus instructed, lost no time in giving full effect to the letter, and the Protestants were everywhere subjected to cruel extortion and gross indignity at the hands of a brutal soldiery. These dragonnades were practised with still greater atrocity in Béarn 1684, and in all the other provinces where the Protestants existed in any considerable numbers. Resistance was attempted in several instances; thousands of the most enlightened merchants and skilful workmen left the country; carrying their talents and industry into the service of its enemies; but the far greater number, seeing resistance hopeless, and overcome by terror, gave in a feigned adhesion.

DRAGON'S BLOOD, a resinous juice obtained by incision from the fruits of the *Calamus draco*, the rattan palm of the East Indies.

Dragon's blood is obtained, in commerce, in three principal forms — in that of oval masses of the size of a pigeon's egg, enveloped with leaves of the pendanus; in cylinders covered with palm leaves, in which form it goes by the name of "reed dragon's blood"; and in irregular masses, marked with impressions of leaves; that in oval masses is the most esteemed.

Dragon's blood is opaque, of a deep reddish-brown color; brittle, and has a smooth and shining conchoidal fracture; when in thin laminæ it is sometimes transparent; melts at 248° F., and when burned it gives out an odor similar to benzoin; its taste is astringent; it is soluble in alcohol, and the solution will permanently stain heated marble, for which purpose it is often used, as well as for staining leather and wood. It is also soluble in benzene, chloroform, carbon disulphide, glacial acetic acid and caustic soda, and sparingly in oil of turpentine and ether. It enters into the composition of a very brilliant varnish, which is much esteemed by artists. The deep red varnish of the violin makers of Cremona was made of pure dragon's blood. Its quality may be tested by marking with it on paper; the best leaves a fine red trace, and commands a very high price. It was formerly in high repute as a medicine, but at the present time is very little used. Other resins to which the same name has been given commercially are those of various trees of the genus *Dracæna* growing on the island of Socotra (whence the trade name, "Socotrine dragon's blood"); the *Pterocarpus draco*, of the West Indies; the *Dalbergia*, of Guiana; a *Croton* of South America and Sumatra and from the *Dracæna draco* (order *Liliaceæ*), which is most celebrated in connection with the Canary Islands. A historic tree of this last species, at Orotava, acquired enormous dimensions, and was visited and celebrated by almost every traveler, including Humboldt, but was destroyed by a storm in 1867. It was supposed to have

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been about 5,000 or 6,000 years old. An astringent resin, obtained from the *Eucalyptus resinifera* of Australia, sometimes gets the name of 'dragon's blood' in that country. Consult *The Geographic Magazine* (April 1918).

DRAGON'S MOUTHS, a strait on the coast of Venezuela, running between the Island of Trinidad and the Paria Peninsula, and leading into the Gulf of Paria.

DRAGOON, a mounted soldier, first introduced into the French army about 1585, and trained originally to fight chiefly on horseback, but, if necessary, on foot also, and mounted, armed, and exercised accordingly. Experience proving that they did not answer the end designed, they were hardly ever used in infantry service latterly, and now form a useful kind of cavalry. The term dragoon probably comes from *dragon,* a short species of carbine carried in 1554, on the muzzle of which, from the old fable that the dragon spouts fire, the head of the monster was wrought. The first dragoon regiment raised in Great Britain was the first Royal, the oldest cavalry of the line regiment in the army, raised in 1661 to garrison Tangier, Morocco. There are at present in the British army three regiments of dragoons, and seven of dragoon guards, all being mounted and accoutred more after the fashion of heavy (or medium) cavalry than the hussar regiments. The three dragoon regiments are the 1st (Royal) Dragoons, the 2d Dragoons (Royal Scots Greys, organized 1683), and the 6th (Inniskilling) Dragoons. Both dragoons and dragoon guards are armed with carbine and sabre, and have metal helmets (except the Scots Greys). Consult White, C., 'Our Regiments' (London 1915).

DRAGOON BIRD. See UMBRELLA-BIRD.

DRAGOUMIS, Stephan, Greek statesman: b. Athens, 1842. He was educated in Athens and Paris and in 1879 became a member of the Lower House of Parliament at Athens. He was Foreign Minister in 1886–90 and again in 1892. In February 1910 he became Premier, but his cabinet was overthrown the following October. During his term of Premier he calmed the Military League and succeeded in having convoked a National Assembly to deal with important public issues. He was opposed to the movement to have Greece openly allied with the Thessalians in their difficulties with Turkey. In 1912 Dragoumis was sent to Crete to take over the government of that island.

DRAGUIGNAN, drā-gēn-yäṅ, France, town, capital of the department of Var; 41 miles northeast of Toulon. It was founded in the 5th century. It contains a prefecture, courthouse, hospital, a fine museum, zoological gardens and a public library. The principal manufactures are woolens, leather, hosiery, silks, soap, lumber, brandy, oil and earthenware. Pop. about 10,000.

DRÄHMS, drāms, August, American Congregational clergyman: b. Yarmen, Pomerania, 4 March 1849. His parents emigrated to the United States in 1856, and his early education was received in the public schools of Geneva, Ill. In 1863, he enlisted in the 17th Illinois cavalry and served to the end of the war. He afterward studied at Wheaton College, and the Garrett Biblical Institute at Evanston, Illinois, and entered the Congregational ministry at Oakland, California, 1878. He served as pastor in Martinez, Cal., and was for 18 years resident chaplain of San Quentin prison. He is pastor of the First Congregational Church of Hilo, Hawaii. He has written 'The Criminal: a scientific study; with an introduction by C. Lombroso' (New York 1900).

DRAIN-PIPE, a pipe used in draining, commonly of tile, but sometimes of wood or metal. See TILES.

DRAINAGE, in agriculture, a method of improving the soil by withdrawing the water from it. Though practised by the Romans, and though the value of drainage was expounded by Walter Blithe in the middle of the 17th century, it was not till after the middle of the 18th century that the importance of drainage began to be understood in Great Britain. The public attention is said to have been then excited by the practice of Elkington, a farmer of Warwickshire, England. But it was James Smith of Deanston, Perthshire, Scotland, who about 1823 led the way in modern practice of thorough draining.

The successful practice of draining in a great measure depends on a proper knowledge of the various strata of which the earth is composed, as well as of their relative degrees of porosity or capability of admitting or rejecting the passage of water through them and likewise of the modes in which water is formed and conducted from the high or hilly situations to the low or level grounds. In whatever way the hills or elevations that present themselves on the surface of the globe were originally formed, it has been clearly shown, by sinking large pits and digging into them, that they are mostly composed of materials lying in a stratified order, and in oblique or slanting directions downwards. Some of these strata, from their nature and properties, are capable of admitting water to percolate or pass through them, while others do not allow it any passage, but force it to run or filtrate along their surfaces without penetrating them in any degree, and in that way conduct it to the more level grounds below. There it becomes obstructed or dammed up by meeting with impervious materials of some kind or other, by which it is readly forced up into the superincumbent layers, where they happen to be open and porous, soon rendering them too wet for the purposes of agriculture; but where they are of a more tenacious and impenetrable quality, they only become gradually softened by the stagnant water below them; by which the surface of the ground is, however, rendered equally moist and swampy, though somewhat more slowly than in the former case.

Where grounds are in a great measure flat, and without degrees of elevation sufficient to permit those over-proportions of moisture that may have come upon them from the higher and more elevated grounds to pass readily away and be carried off, and where the soils of the land are composed or constituted of such materials as are liable to admit and retain the excesses of moisture, they are exposed to much injury and inconvenience from the retention and stagnation of water. Such lands consequently require artificial means to drain and render them capable of affording good crops, whether of grain or grass.

Wetness of land, so far as it respects agriculture and is an object of draining, may generally depend on the two following causes:— first, on the water which is formed and collected on or in the hills or higher grounds, filtrating and sliding down among some of the different beds of porous materials that lie immediately upon the impervious strata, forming springs below and flowing over the surface, or stagnating underneath it; and, secondly, on rain or other water becoming stagnant on the surface, from the retentive nature of the soil or surface materials, and the particular nature of the situation of the ground. The particular wetness which shows itself in different situations, in the forms of bogs, swamps and morasses, for the most part proceeds from the first of these causes; but that superficial wetness which takes place in the stiff, tenacious, clayey soils, with little inclination of surface, generally originates from the latter.

Drains.—The drains used in land drainage may be divided into two classes — open and covered drains. These again may each be subdivided into drains intended merely to act as water-courses and drains which, in addition to acting as water-courses, are also intended to carry off the surplus water from the land through which they pass.

Open Drains.— The rudest forms of open drains are the deep furrows, lying between narrow highbacked ridges, which are still to be found in some parts of the country with their accompanying water-furrows ("gaw" furrows or "grips") for discharging their streams. These are only meant to carry off the surplus water after the soil is completely saturated. In doing so, however, they carry along with it all the best portions of the soil and of the manure which may have been spread upon its surface.

Open Drains as Water-courses.—The ordinary ditch (dike) is the common form of this kind of drain, which, though necessary to a certain extent, ought, nevertheless, to be sparingly seen where a perfect system of drainage has been effected. They are constant sources of annoyance and expense from their sides crumbling in, the numerous weeds which they harbor and the thorough scouring which they require every year. Open ditches occupy an important place in the early stages of draining bogs; but after the bog has become consolidated the greater portion of them may be dispensed with and their places supplied by large covered drains.

Open Drains for Collecting Water from the Land through which they pass (Sheep-drains).— These are employed in drying the surface of mountain pastures, where a more expensive and perfect system of drainage would not yield an adequate return for the outlay. They consist of trenches of 12 or 16 inches in depth and 18 in width, placed so as to intercept all the water which may flow from portions of land above them. They are opened at intervals in a direction nearly transverse to the line of the greatest slope and should have sufficient inclination to keep the water flowing toward the mains or leaders. These latter should be cut in the hollows or in such other places as will permit the small drains or feeders to empty themselves most readily into them, and be made to discharge into the nearest water-courses.

Covered Drains.— We now come to the consideration of the more important description of drainage — the removal of water by means of covered drains. The simplest of all the forms of these are what are called mole-drains, and they are formed by means of a machine called the mole-plough. This machine consists of a wrought-iron frame on four wheels, the front pair being connected with worm and chain steerage. A coulter with pointed sock, capable of being raised and lowered to regulate the depth of the drain, is attached to the frame. The "mole," an oval piece of iron three and one-half inches in diameter, follows the sock, to which it is attached by a short chain. The track which the mole leaves in the ground is the water channel. This machine is dragged through the soft clay, which is the only kind of land on which it can be used with propriety, by means of a windlass on the fore end of the frame and a double length of wire-rope wound by an engine on the higher part of the field. A team of horses returns it to the lower side, out of work.

Wedge-drain.— The wedge-drain, like the mole-drain, is merely a channel formed in the subsoil, and, like it, can only be used in pasture lands. In forming wedge-drains, the first spit, with the turf attached, is laid on one side, and the earth removed from the remainder of the trench is laid on the other. The last spade that is used is very narrow, and tapers rapidly, so as to form a narrow wedge-shaped cavity for the bottom of the trench. The turf first removed is then cut into a wedge, so much larger than the size of the lower part of the drain that, when rammed into it with the grassy side undermost, it leaves a vacant space somewhat triangular in shape in the bottom of six or eight inches in depth.

Permanent drains are of two kinds, stone and tile drains.

Stone-drains.— These are either formed on the plan of open culverts of various forms, or of small stones in sufficient quantity to permit a free and speedy filtration of the water through them. As a specimen of the former of these, we may instance the *box-drain*, which is formed of flat stones neatly arranged in the bottom of the trench. The largest and flattest stones are used in laying the bottom and for covers; the smaller ones are placed on the sides, the whole forming an open tube. The second description of stone-drains, generally known as the broken-stone or rubble drain, is not so thoroughly effective as the first.

Tile-drains or Sewer-pipe drains.— Of all the materials which have yet been brought forward for forming the conduits of drains, none are so well fitted for the purpose as tiles or pipes of burnt clay. Draining tiles, especially those in the form of pipes, possess all the qualities which are required in the formation of drains, affording a free ingress to water, while they effectually exclude vermin, earth, and other injurious substances. When first introduced they were of clumsy construction, and being hand-made, sold at a high price. They are now made of ordinary clay and vitrified clay to resist the moisture, and also of concrete. The vitrified are most durable but the concrete or cement pipe is largely used; the best form appears to be the cylinder. Good pipes are straight, smooth and free from flaws, and when struck should

ring clearly. Durability is shown if the wet pipe will dry quickly before a hot fire without crumbling. Where a sudden descent occurs in the course of a drain, or where there is a running sand or a boggy place, pipes of one size should either be entirely sheathed in larger ones, or they should be furnished with collars. These collars are merely short sections of pipes of such a size as to fit upon smaller ones, by which means the smaller ones may be so joined end to end as to prevent them from slipping down past each other.

The drawing off of the pent-up waters which are the sources of springs is a department of draining which requires a considerable knowledge of the different varieties of strata.

In the laying out of drains, the first point to be determined is the place of outfall, which should always afford a free and clear outlet to the drains, and must necessarily be at the lowest point of the land to be drained. This should be ascertained by a leveling instrument; and where a large extent of work is to be done, a competent surveyor should always be employed. A simple form of level for this purpose is a length of ordinary garden hose, with a glass tube in each end. When the hose is filled with water, the height in the two end tubes will be equal. Two persons with such a level can easily mark desired heights on a row of stakes, and so get any desired inclination. The outfalls should be as few as possible, and each one should be carefully set in brickwork and covered by a grid hinged at the top to prevent the ingress of rats and moles, but capable of giving way to a sudden rush of water from drains above. The next point to be determined is the water level or water table. This may be ascertained by digging test holes in different parts of the field and noticing the height to which the water rises in them. In an undulating field the height will vary in different places, but the knowledge gained by means of the test holes of the nature of the soil and subsoil will indicate the depth of draining required. In general it will be found that in clay land the drains should be shallow and close together, and in sandy or light land deeper and wider apart; the looser nature of the lighter soil permitting the rapid percolation of water, and allowing the drains to draw from a wider area. Drains in arable land must be beyond the influence of agricultural implements; not only out of the reach of plough or cultivator, but too deep to be displaced by their passing weight. Less than two feet six inches from the surface is unsafe, except in very stiff clay pasture land which is never disturbed. The depths usually adopted in practice for the various classes of soils are as follows:

Stiff clay	2 ft. 6 in. to 3 ft.
Medium soils	3 ft. 3 in. to 3 ft. 6 in.
Light soils	3 ft. 6 in. to 4 ft. 6 in.

As to the distance apart, experience has established a rule that in clay soils a drain will "draw" an area of from 5 to 6 times its depth, on medium soils 7 to 9 times, and on light soils 8 to 10 times its depth. Thus 3-foot drains in the first case might be 15 feet apart, in the second 24 feet, and in the third 40 feet apart. Submains may be necessary in an undulating field and in all cases they are desirable where the minor drains would otherwise be more than 10 chains in length. The rate of fall of any drain must not be less than 1 in 200. All drains should be kept as far as possible from the roots of trees, and curves are to be avoided, except at the junction of minor with main drains or submains, when the junction must form an acute angle, the smaller drain curving toward the larger drain and entering it from above. Two minor drains must not enter a large drain opposite to each other, or the stoppage thus caused will result in the deposition of silt and consequent chokage of the drain.

Drains are cut from the lowest point upward and the pipes laid in each section day by day. To ascertain if the pipe bed is being laid perfectly true, three leveling staves or "boning" rods are used. Each consists of a staff and crosshead, and by placing them at various points in the drain and sighting over the crossheads, uniformity of the bed is determined. The surface soil in cutting the drains ought to be laid on one side of the trench and the subsoil upon the other side, and each should be returned carefully to its original position. The size of the pipes to be used is dependent upon a number of factors, such as character of soil and subsoil, gradient, rainfall and length of drains; but in practice it is found most profitable to use 2½-inch to 3-inch pipes for minor drains, and 6-inch, 8-inch or 10-inch for mains and submains. The number of pipes required per acre is found by dividing the area of an acre in square feet by the distance between the drains in feet, provided the pipes are one foot in length. The following table will be of value in this particular:

Minors	Lengths up to 500 feet,	2 in.
	Lengths 400 to 700 feet,	2½ in.
	Lengths 500 to 1,000 feet,	3 in.
Mains	2 to 3 acres	3-inch tiles.
	4 to 8 acres	4-inch tiles.
	10 to 15 acres	6-inch tiles.
	20 to 40 acres	8-inch tiles.
	40 to 100 acres	10-inch tiles.

The tools used in the formation of drains are few in number, and of a very simple description. They consist of a set of spades — generally three of different sizes—gradually diminishing in width to suit the different parts of drains. For taking out the last narrow spit, to form the seat for the draining pipe, long, narrow, triangularly shaped spades, called bottoming tools, are used. There are also scoops of various widths, furnished with long handles, and rounded or flattened in the soles according as they are required to finish the bottom of the drain for the reception of stones, a horse-shoe tile and sole, or a draining pipe. For the purpose of laying pipes in minor and deep drains an instrument called a pipe-layer, consisting of a short rod attached at a right angle to a long handle, which enables the workman to lay the pipes without going into the drain or reaching the bottom with his hand, is employed. Where the subsoil is strong or indurated, a hand-pick or a foot-pick is required to loosen it before it can be shoveled out.

Benefits of Drainage.— The following are among the benefits arising from thorough drainage:

1. Removal of superfluous water. Not only is the standing water at the surface carried off, but the water-table is lowered, increasing the

depth of soil. Energy that would otherwise be required for evaporation of water is thus saved for the immediate benefit of vegetation.

2. Improves soil texture. Drained soils are more friable, less lumpy, offer less resistance to plant roots, and are of better texture in every way, than undrained soils.

3. Increases root pasturage. Agricultural literature is full of testimony to the benefits of deep tillage. The deeper the soil is stirred the greater its productiveness. Plant roots penetrate to a depth of several feet under favorable conditions such as drainage supplies. Root pasturage is also increased by the increase of surface presented by the much finer division of soil particles.

4. Increases soil fertility. It prevents loss of fertility by water passing over the surface. It adds to the fertility by sending summer showers down through the soil, instead of over them, enabling the crop to use the nitric acid and ammonia brought down. It increases the effect of manures by bringing them more quickly into solution and into more intimate contact with plant roots; and it increases the absorptive power of soils for fertilizing matter in solution.

5. Makes tillage easier. By clearing up waste places and covering ditches the field is brought into better shape for use of labor-saving machinery. Waste land is reduced, and the better texture of soil, its finer tilth and greater friability decrease draft and increase the effectiveness of tillage implements.

6. Lengthens the growing season for crops. Frost comes out earlier in the spring and the land becomes earlier warmed. Evaporation lowers temperature, but drainage removes water without evaporation. A well-drained soil is 12° to 14° F. warmer than a soil full of stagnant water. The sun's rays penetrate to a greater depth, and warm summer showers have a greater effect. The season is lengthened by adding the days in summer after heavy rains when undrained soils cannot be tilled, and crops come to a standstill; coming of the autumn is delayed until later, and the soils are warmer throughout the season.

7. Assists disintegration. Frosts penetrate deeper in winter in drained soils, assisting in unlocking the stores of mineral plant food. More surface is exposed to the action of disintegrating agents, and the soil presents conditions more favorable to their action throughout the season.

8. Favors nitrification and bacterial action. Plants are largely dependent on the decomposition of organic matter in the soil for their supply of nitrogen. This change is brought about by the action of ferments or bacteria which thrive only under certain conditions of temperature and moisture. Drainage supplies the most favorable condition for their development; it also favors the growth of the nitro-bacteria found on the roots of leguminous plants, which by their means appropriate free nitrogen from the air.

9. Prevents heaving. The effect of stool-ice in throwing out young plants in winter is often to diminish seriously and even destroy the crop. Drainage dries up the surface soil and prevents the formation of stool-ice.

10. Lessens washing and diminishes violence of floods. By increasing the absorptive power of the soil less water is left to pass over the surface in a rainy season, so that washing and floods are materially lessened.

11. Improves the quantity and quality of crops. That the yield of crops is much greater on drained soils hardly needs to be substantiated, while the more vigorous growth of plants renders them much less susceptible to the attacks of fungi or the ravages of insects, thus improving the quality. Rust, mildew, blight, etc., are much less prevalent in crops on drained soils.

12. Diminishes the effect of drought. By making the season earlier tillage can begin sooner and save moisture from wasting. Plants are given a bettter start and root deeper, thus being less affected by a dry surface. The soil is deeper and has greater capacity for moisture. Its finer texture nearly doubles its capillary power over undrained soils. Ordinarily drainage increases the capillary power of soils from 25 to 40 per cent. A drained soil holds water like a sponge, an undrained clay like a dish.

13. Healthfulness improved. So well known is this fact that large towns have undertaken the drainage of adjacent swamps at public expense to render the region more healthful. See AGRICULTURE; SANITARY ENGINEERING; SANITARY SCIENCE and PUBLIC HEALTH.

Among the later authoritative books on drainage, Chamberlain, 'Tile Draining'; Klippart, 'Land Draining'; French, 'Farm Draining'; Miles, 'Land Draining'; Waring, 'Draining for Profit and Health'; Jeffrey, 'Text Book of Land Drainage' (1916).

DRAINAGE OF MINES. See MINES, DRAINAGE OF.

DRAINAGE TUBES, in surgery, an appliance invented by a distinguished French surgeon, M. Chassaignac. They are composed of india-rubber, from one eighth to three-eighths inch in diameter, perforated with numerous holes, and of various lengths. They are introduced into the abscess or wound so that one end is in contact with the seat of discharge, while the other reaches to the surface of the skin. They are especially useful in chronic abscesses, but also in large wounds, such as those made by amputation, and in all cases where there is apt to be a deep accumulation of discharge.

DRAKE, Alexander Wilson, American artist and critic: b. Westfield, N. J., 1843; d. New York, 4 Feb. 1916. He studied and practised wood engraving and later drew on wood for engravers. He also studied oil and water color painting and taught drawing at Cooper Institute. He was in business for himself as a wood engraver from 1865 until 1870 and was head of the art department of *Scribner's Monthly* when it became the *Century*. He remained with the *Century* until 1913.

It was to Mr. Drake's knowledge of wood engraving and of pictorial arts and to his distinguished taste that the reputation of *Century Magazine* on the artistic side was mainly due. He was known as the "Father of American Wood Engraving" because of the experiments he made in the reproduction on wood of the many processes of illustration, such as paintings in oil and water colors, etching, crayon drawing, etc. He was a connoisseur of painting and the allied arts and his collections, which were unique

and varied, included paintings, copper and brass and many other articles of beauty and curiosity.

DRAKE, Charles Daniel, American lawyer: b. Cincinnati, 11 April 1811; d. 1 April 1892. He served several years in the navy, was admitted to the bar in 1833, and in 1834 took up the practice of law in St. Louis, where he became prominent in politics. In 1864 he was a member of the convention to revise the Constitution of Missouri; in 1867–71 he was United States Senator; and in 1871–85 Chief Justice of the Court of Claims. He wrote 'Law of Suits by Attachment' (1854); 'Life of Daniel Drake' (1871); and published a collection of his speeches under the title 'Union and Anti-Slavery Speeches' (1864).

DRAKE, Daniel, American physician: b. Plainfield, N. J., 20 Oct. 1785; d. Cincinnati, Ohio, 6 Nov. 1852. He was graduated from the University of Pennsylvania in 1815, and settled for a time in Cincinnati. He was professor of materia medica in Transylvania University, Ky., and taught in other medical schools till 1820, when he organized the Medical School of Ohio in Cincinnati; he was professor there, and in the University of Louisville, Ky. He wrote 'Pictures of Cincinnati and Miami County' (1815); 'Practical Treatise on the History, Prevention and Treatment of Epidemic Cholera' (1832); 'Systematic Treatise on the Principal Diseases of the Interior Valley of North America' (1850–54); and was editor of the *Western Medical and Physical Journal.*

DRAKE, Sir Francis, English navigator: b. probably in Tavistock, Devonshire, England, about 1540; d. off Porto Bello 28 Jan. 1596. When very young, he served as an apprentice to a sea captain and later became a coast trader. He joined Sir John Hawkins in his last expedition against the Spaniards (1567), losing nearly all he possessed in that unfortunate enterprise. Having gathered a number of adventurers round him he contrived to fit out a vessel in which he made two successful cruises to the West Indies in 1570 and 1571. In 1572 with two small ships he again sailed for the Spanish main, captured the cities of Nombre de Dios and Vera Cruz, burned Porto Bello, captured and destroyed many Spanish ships, crossed the isthmus to the highest point of the dividing ridge, where, climbing a tree from whose tops the guides told him both seas could be seen, he gazed upon the vast waters of the South Seas, and with that touch of romantic enthusiasm that redeemed all his piracies, "besought Almighty God of His goodness to give him life and leave to sail once in an English ship in that sea." Drake arrived in Plymouth on Sunday, 9 Aug. 1573, during sermon-time, when the news of his return "did so speedily pass over all the church, and surpass their minds with desire and delight to see him, that very few or none remained with the preacher, all hastening to see the evidence of God's love and blessing toward our gracious queen and country."

In 1577 he fitted out a small squadron, consisting of his own ship the *Pelican,* the *Elizabeth* and three smaller vessels, and with these sailed from Plymouth on 13 December. On 20 August the squadron, now reduced to three ships, entered the Strait of Magellan, and here Drake changed his own ship's name from the *Pelican* to the *Golden Hind.* In 16 days they made the passage, then followed violent tempests for 52 days, during which the *Marigold* foundered with all hands and the *Elizabeth* parted with the admiral and resolved to return home. At Valparaiso Drake provisioned his ship from the Spanish storehouses, reached Callao on 15 Feb. 1579, found a rich prize off Cape Francisco (1 March) and another on 4 April. Drake now determined to return home by crossing the Pacific. He touched land at a creek on the northern side of the Golden Gate, then for 68 days together had no sight of land until he made the Pelew Islands. After refreshing three weeks at Ternate, and a thorough refit on the southwest coast of Java, he held for the Cape of Good Hope, and arrived in England 26 Sept. 1580. The queen paid a visit to his ship at Deptford, and knighted him on its deck.

In the autumn of 1585 Drake sailed with a fleet of 25 ships against the Spanish Indies, harrying Hispaniola, Cartagena, and the coast of Florida, and brought home the 190 dispirited Virginian colonists, with tobacco and potatoes. Early in 1587 he set sail with a strong squadron to cripple the king of Spain in his own seas, and retard his preparations for invasion — a sport which he called "singeing the king of Spain's beard." Sailing right into the harbor of Cadiz, he sank or burned as many as 33 ships, and made his way out unscathed. The seeming recklessness of his tactics was no devil-may-care bravado, but due to consummate seamanship no less than promptitude and courage. Drake next sailed to the Azores, capturing a rich homeward-bound Portuguese carack worth £100,000. In the face of the impending struggle for which Philip II had long been preparing, his persistent plan was to follow up the policy of harassing the enemy on his own coasts — "to seek God's enemies and her majesty's where they may be found."

Drake's division in the threefold arrangement of the English fleet was at first stationed off Ushant, until all the ships were blown together to Plymouth by the same storm that carried the Spaniards across the Bay of Biscay. Here, on the Hoe, the admirals and captains were playing the famous game of bowls, when the news was brought that the enemy was off the Lizard. Howard was eager to put to sea at once, but Drake would first finish the game, saying "there's plenty of time to win this game, and to thrash the Spaniards too." The story, whether true or no, is in perfect keeping with the character of the man. Early next morning the battle began, and raged along the Channel throughout the week. Drake's consummate seamanship and audacious courage covered him with fresh glory, and inspired new terror in the Spaniards. On 29 July occurred the final action so disastrous to the Spaniards, after which they came to their fatal determination to return to Spain round the Orkneys. Two days later Drake wrote to Walsingham, "There was never anything pleased me better than the seeing the enemy flying with a southerly wind to the northward. God grant you have a good eye to the Duke of Parma, for with the grace of God, if we live, I doubt it not, but ere it be long so to handle the matter with the Duke of Sidonia, as he shall wish himself at Saint Mary Port among his orange trees." It was not long before want of ammunition compelled Drake and Howard to fall back from the chase, but the

storms of the northern seas took up their work and swept the Spaniards to destruction. Next spring a great expedition under him and Sir John Norreys sailed for the coasts of Spain and Portugal, but had little success beyond the damage inflicted upon the Spanish shipping, while sickness and actual hunger carried off thousands on board the crowded and ill-victualed ships. In August 1595, he sailed from Plymouth on his last expedition to the West Indies. Ill-fortune followed the fleet from the beginning; Hawkins, the second in command, died off Porto Rico in November, and Drake himself fell ill and died off Porto Bello. Consult the 'Life' by Barrow (1843); Froude, 'English Seamen of the 16th Century' (1895); Julian Corbett, short 'Life' (1890); and his 'Drake and the Rise of the Tudor Navy.'

DRAKE, Francis Marion, American capitalist and lawyer: b. Rushville, Ill., 30 Dec. 1830; d. Centreville, Ia., 20 Nov. 1903. In 1837 his family moved to Iowa, where he was educated. In 1852 he crossed the plains to California with ox-teams, encountering and defeating a band of Pawnee Indians on the route, and in 1854 crossed again with a drove of cattle. In 1855 he engaged in mercantile business in Drakeville, Ia., and in 1861 entered the army as a private. He served through the Civil War, attaining the rank of brigadier-general of volunteers. After the war he studied and practised law, and engaged in the railroad business, particularly the building of new roads. He was the first president of the Missouri, Iowa and Nebraska Railroad, and was later president of the Albia and Centreville Railroad. In 1880 he founded Drake University (q.v.) which he liberally endowed, and was president of the board of trustees till the time of his death. He was one term (1896–98) governor of the State of Iowa, being elected on the Republican ticket.

DRAKE, Francis Samuel, American historical writer: b. Northwood, N. H., 22 Feb. 1828; d. Washington, D. C., 22 Feb. 1885. He was a son of S. G. Drake (q.v.). He prepared a 'Dictionary of American Biography' (1872). He also published 'Life of Gen. Henry Knox' (1873); 'Tea Leaves' (1884); and 'Indian History for Young Folks' (1885). Before his death he had gathered material for a new edition of his 'Dictionary,' which was incorporated in 'Appleton's Cyclopædia of American Biography.'

DRAKE, drä'kĕ, **Friedrich,** German sculptor: b. Pyrmont, 23 June 1805; d. Berlin, 6 April 1882. He was the son of a mechanic, and after an apprenticeship in cabinet-making turned to clay modelling and studied under Rauch. He traveled also in Italy, where he met Thorwaldsen (1836–37) by whom he was influenced somewhat. Among his works are 'The Eight Provinces of Prussia' (colossal allegorical figures adorning a hall in the royal palace at Berlin), and a 'Warrior crowned by Victor,' which is reckoned one of the masterpieces of German sculpture. Noteworthy also are his portrait sculptures of Goethe, Schiller, Rauch; the marble statue of Frederick William III in the Thiergarten, Berlin; that of Christian Rauch, at Berlin; and the colossal bronze representing William I, on the Hohenzollern Bridge of Cologne, for which he was awarded the cross of the Legion of Honor. His work is marked by virility and classic simplicity. He was professor of the Academy of Art at Berlin, and a member of the academies of all the leading countries of Europe. Consult Heinrich, 'Rauch, Reitschel and Drake' (Basel 1884).

DRAKE, Joseph Rodman, American poet: b. New York, 7 Aug. 1795; d. there, 21 Sept. 1820. He studied medicine, traveled in Europe, and after his return in 1819 contributed under the signature of "CROAKER" many pleasant and effective verses to the New York *Evening Post*. His friend Fitz-Greene Halleck joined him in this series, signing his own pieces at first "Croaker, Jr.," but soon they both adopted the signature of "Croaker & Company." The novelist Cooper was also one of the intimate associates of Drake and a conversation between them as to the poetical uses of American rivers, in the absence of historical associations, such as belong to the streams of the old world, was the occasion of Drake's longest and most imaginative poem, the 'Culprit Fay.' This, with his other poems, was published in 1835. The poems published with Halleck appeared in book form in 1860.

DRAKE, Samuel, American actor: b. England, 15 Nov. 1768; d. Oldham County, Ky., 16 Oct. 1854. He may properly be called the pioneer of the drama in the west. It is said that his name was Bryant, but he assumed that of Drake on the stage. In early life he was apprenticed to a printer, but ran away before his term had expired and went on the stage. Previous to his coming to the United States he was manager of a country theatre in the west of England. He arrived in America with his family in 1809 and appeared at the Boston theatre the same year, remaining there until 1813, when they joined a company at Albany, N. Y., where Mr. Drake became stage-manager. Mrs. Drake died in 1814 and her husband removed the following year to Kentucky, having previously arranged to take over theatres in Frankfort, Lexington and Louisville. On the way his company gave several performances in towns of western New York. Among the company were N. M. Ludlow and Miss Denney, who later were prominent on the American stage. From Olean to Pittsburgh, Pa., the company floated on a flat-boat down the Alleghany and in Pittsburgh gave the first regular theatrical performance ever seen in that town. From Pittsburgh the company went to Maysville (Limestone) and thence overland to Frankfort. Drake was very successful in Kentucky and afterward managed houses in Ohio, Tennessee, Missouri and Indiana.

DRAKE, Samuel Adams, American journalist and writer: b. Boston, 20 Dec. 1833; d. Kennebunkport, Me., 4 Dec. 1905. He entered journalism in 1858. In 1861 he joined the army and served throughout the war, becoming brigadier-general in 1863. He returned to Boston in 1871 and resumed literary work. His most important publications are 'Old Landmarks of Boston' (1873); 'Nooks and Corners of the New England Coast' (1875); 'Around the Hub' (1881); 'Heart of the White Mountains' (1882); 'New England Legends and Folk Lore' (1884); 'The Making of New England' (1886); 'The Making of the Great West'

(1887); 'Burgoyne's Invasion' (1889); 'The Taking of Louisburg' (1891); 'The Pine Tree Coast' (1891); 'The Battle of Gettysburg' (1892); 'The Making of Virginia' (1893); 'Our Colonial Homes' (1894); 'The Campaign of Trenton' (1895); 'The Watch Fires of '76' (1895); 'On Plymouth Rock' (1898); 'The Myths and Fables of To-day' (1900); 'The Young Vigilantes' (1904); etc.

DRAKE, Samuel Gardner, American antiquarian: b. Pittsfield, N. H., 11 Oct. 1798; d. Boston, Mass., 15 June 1875. He received a common school education and from 1815–25 was a school-teacher in a country district. In 1828 he removed to Boston and there opened one of the first antiquarian book-stores established in the United States. He was one of the founders of the New England Historical and Genealogical Society, acted as its president in 1858, and was editor of its quarterly 'Register' for many years. He published 'Indian Biography' (1832); 'Book of the Indians' (1833); 'The History and Antiquities of Boston' (1856); 'History of the French and Indian War' (1870); 'Old Indian Chronicle' (1836); 'Indian Captivities' (1839); 'Annals of Witchcraft in the United States' (1869). He also edited Church's 'Entertaining History of King Philip's War' (1825); Mather's 'Indian War of 1675–76' (1862); 'Early History of New England' (1864); Hubbard's 'Indian Wars' (1865).

DRAKE UNIVERSITY, a co-educational institution in Des Moines, Ia.; founded in 1881, under auspices of Church of Christ. It was named for Gen. Francis Marion Drake, its benefactor, whose gifts amounted to $230,000, and who served as president of the board of trustees from the board's organization until his death, 20 Nov. 1903. Linked with the name of Drake as founder, is the name of D. R. Lucas, through whose influence the institution was located in Des Moines, and that of George Thomas Carpenter, its first chancellor and the moving spirit of the new enterprise. Total assets of the university, $530,000. Available income about $90,000 annually. There are eight organized colleges; liberal arts, Bible, law, medicine, normal, conservatory of music, pharmacy, dentistry, also eight special schools. Enrolment for year 1915–16 was 1,466. General control is vested in board of trustees, composed of (1) life members; (2) members elected by Iowa Christian Convention; (3) members elected by Alumni Association. The president of the university, under direction of board, is head of the school.

DRAKENSBERG, a mountain range of South Africa, which extends from the eastern part of the Cape of Good Hope province along the Orange State frontier to the northwest frontier of Natal. The range is steep on the side facing the sea but slopes gradually inland to the South African plateau. It attains a height of from 10,500 to 12,000 feet in the peaks Mont-aux-Sources and Champagne Castle and Giant's Castle is 9,600 feet high. Its two passes of Van Reenan (5,400 feet) and Laing's Nek (4,100 feet) are traversed by railroads.

DRAMA, a Greek term meaning action, and applied to that form of literature which is suited for performance, or action, before an audience. A drama tells a story by means of speeches and dialogue, and these are to be spoken by actors impersonating the characters and performing the actions of the story. Speech, gesture, facial expression, makes, pantomine, stage "business," music, dancing, scenic painting are some of the theatrical accompaniments by means of which the dialogue has been made to imitate scenes from life. (See THEATRE). Since mimicry is as old as the race, it is evident that there have been from times of primitive culture dramatic elements in games, sports, dances, religious ceremonies and other mimetic performances; but it is only late in the development of civilization that the drama takes an important place in literature. Nor can the use of dialogue, as in the Book of Job or in mediæval estriis, be taken as constituting a dramatic literature. The dramatic tendencies in life and literature have resulted in the various nations in definite literary forms, given regular theatrical presentation; and it is the history of these that this article discusses.

Although in modern times dramas have frequently been written in prose, the drama in classical times was regarded as one of the three divisions of poetry, and so differentiated from epic, the narration of events, and lyric, the expression of emotion, and the same distinction is still applied in a general way to literature. An other distinction due to the Greek is the division of drama into two species, tragedy and comedy; the former dealing with the more serious themes of life and especially with suffering and death, the latter with life's follies and absurdities, fun and sentiment. This distinction was not made in Indian, Chinese or mediæval drama, and the two species have varied in different countries and centuries; and there have always existed dramas which stand outside the strict limits of either class; as *satyric* in Greek, *morality* in the Middle Ages, *tragi-comedy* and *pastoral* in the Renaissance, *drame* in modern French, and *melodrama* at present denoting a mixed and uncritical form. Nevertheless the two species survive and remain fairly comprehensive, the commonly accepted distinction between the two depending on the presence of a happy or an unhappy ending.

The drama of India has been the object of much interest to Western scholars since the translation by Sir William Jones in 1789 of 'Sakuntala,' one of the masterpieces of Kalidasa, the greatest of Sanskrit dramatists. The drama of China, of much later development, offers, like that of India, many points of difference from European drama. The earliest examples of the drama, however, are found in Greek, and with these we may begin a survey of the historical development and the general characteristics of the literary drama of Athens, Rome, the Middle Ages and Modern Europe.

Athens.— Greek drama had its origin in the dithyrambic songs chanted by the choruses who impersonated the satyr followers of Dionysius in the festivals in honor of the god. Spoken verses and dialogue were after a time introduced in the midst of the choral odes, and from this beginning both tragedy and comedy eventually developed. To Thespis (650 B.C.) is credited the addition to the chorus of an actor to fill in with speech and mimicry the intervals of singing and dancing. He was the founder of Attic tragedy, which continued to develop

rapidly during the next century. The connection of the drama with the worship of Dionysus was maintained; and tragedies were performed at prize dramatic contests instituted in honor of the god, supported by the state, and witnessed by vast concourses of citizens. No plays survive from before the time of Æschylus (b. 525 B.C.); and to him and to his immediate successors, Sophocles and Euripides in the 5th century, Attic tragedy owes its highest development and its long-continued eminence and influence in the dramatic literature of the world.

The dithyrambic chorus, originally of 50 men, was separated into four choruses of 12 or 15 each, and plays were composed in groups of four, three tragedies, sometimes forming a trilogy on one subject but later usually on disconnected themes, and a fourth satyric play, retaining the satyrs of the ancient festivals. Each play consisted of a series of passages of dialogue interspersed by the odes of the chorus. The dialogue introduced various persons and developed a complete story, usually taken from mythology and dealing with the life of some particular hero. Not more than three actors shared in the dialogue at one time, the second actor having been introduced by Æschylus, and the third by Sophocles. The chorus occasionally took part in the dialogue, but its main function was the singing of odes with accompaniment of music and dancing. In Æschylus the chorus is of great importance, and its explanations, advice, and lamentations are essential to the representation of the action; but by the time of Euripides, its part is subordinate and its odes often have no connection with the dialogue. Although subjects were drawn from mythology, and the same story was often treated by several dramatists, large freedom was permitted in the treatment of the myths, and consequently there is development in subject matter as in form. Æschylus treats the myths as supernatural revelations and deals with the course of fate or Nemesis rather than with the conflict of human motives. Sophocles is interested in human nature and in moral law, in human life rather than in the supernatural. Euripides treats the myths with free invention and in a realistic and even skeptical fashion, transforming gods and heroes into men and women of the day, delighting in situations of emotional intensity, and making the passion of love for the first time of capital importance as a dramatic motive.

The symmetry and unity of Attic tragedy were in part the result of limitations imposed by the conditions of the theatrical performance, resulting in the three unities, the value of which has been the subject of much controversy in modern times. The unity of action involved the restriction of the incidents of a play to those strictly concerned with the main action; the unity of time confined the events of the action to a single day; and the unity of place to a single place. In spite of these and other restrictions already noted, the plays, though wanting the wealth of incident and the variety and surprise common to the best modern plays, are by no means lacking in human interest. Moreover, they represent the height of poetic style. The splendor and beauty of their language and the exquisite perfection of their versification as well as the power and truth of their representation of human character and deed, place them among the consummate products of the imagination. After the 5th century tragedies continued to be numerous and popular not only in Athens but in other Greek towns; and later the plays of the great dramatists and of some of their successors were performed in Alexandria and Rome. Only fragments of later tragedy, however, have survived.

Comedy, like tragedy, sprang from the worship of Dionysus, developing from the frolic and buffoonery of the harvest festival. Farces were exhibited early in the 6th century, but the first great comic writer was Aristophanes. His comedies were satirical and burlesque criticisms of the life of Athens in his day, dealing with political and intellectual tendencies and fashionable follies, and putting no limit to direct personal satire. Socrates, for example, was caricatured in the 'Clouds' and Euripides in the 'Frogs.' Aristophanes, however, was a lyrical poet as well as a great humorist; and his comedies are medleys of satire, caricature, wit, humor, buffoonery, wisdom, fantasy and poetry. This, the "old comedy" of Athens, was followed in the 4th century by "middle comedy," which avoided political and personal matters, and by "new comedy" (320–250 B.C.), the ancestor of the modern comedy of manners. The chief representative of the new comedy was Menander, whose work down to to-day survived only in fragments and in the translations and imitations of the Roman Terence, but who may be better understood if recently announced discoveries answer to the expectations raised.

Rome.— The early development of the drama in Rome seems to have been similar to that in Greece and other countries; but as no representatives of the early folk drama or the Atellan farces have survived, it is impossible to trace any peculiarities in its national development. Roman drama is, indeed, known to us only in the works of three writers, the comedies of Plautus and Terence and the tragedies of Seneca. In this late development it is only a borrowing from the Greek. Terence, aiming at literary excellence and protesting against the coarseness and brutality of his audiences, seems to have imitated or even translated Menander without attempt at any departure. Plautus while he also followed the new comedy of the Greeks, appears to have derived some of his characteristics from the earlier Roman farces, and at all events exhibits a coarseness and directness of humor suited to his audience and characteristic of Roman taste. These Roman comedies served as models and incentives for the dramatic writers of the Renaissance, and its stock characters and lively intrigue have had an influential existence down to the present day. In the same way the tragedies of Seneca served as models for the humanists and became the main classical influence upon modern tragedy. Probably never acted, they were rhetorical imitations of Euripides and later Greek tragic-writers, preserving in the main the form of Attic tragedy, dealing with the most sensational and bloody stories from Greek mythology and abounding in extravagant declamation and sententious philosophizing. Still another inheritance for future ages came from the very dregs of the Roman theatre, the *Mimes*. The theatre in the later empire ceased to be the home of the

drama, and was given over to bloody spectacle and indecent pantomime. Attacked violently by the early fathers, it ceased with the triumph of Christianity; but the dispersed mimes became the ancestors of the traveling entertainers of the Middle Ages, and the traditions of clownery and farce were handed down from generation to generation.

The Middle Ages.— After the destruction of the theatres by the Christians, all knowledge of the classical drama or theatre practically disappeared. An extensive and multiform drama arose without dependence on classical precedent, never in any nation attaining much literary value, but of interest to the student both as a most significant illustration of the life of long centuries and as a potent influence upon modern drama. The origins of this mediæval drama are various. Games and sports offer their share of mimetic performances, tracing back apparently as did the Dionysiac festival at Athens to early celebrations of spring and harvest; and the popular entertainers, the direct descendants of the Roman mimes, seem to have exercised an effect, not easily traceable, on comedy, especially on the *farces* and *sottises* in France. The main stream of mediæval drama, however, had its origin in the Church liturgy. The Church service contained many manifestly dramatic elements; and the "offices," especially those for Easter and Christmas, were gradually expanded into little plays that grew into the mysteries, miracles and moralities of later times. The steps in this growth cannot be traced with chronological exactness, but the process was one of secularization, the removal of the play from the service, from the Church itself, and eventually from the hands of clerical actors, and the intrusion of the vernacular and its final triumph over the Latin of the Church service. The institution of the Festival of Corpus Christi (1264, confirmed 1311) gave new support to these plays, and during the 14th and 15th centuries their vogue under control of the guilds and other lay organizations became enormous, in spite of the protests of the Church, which began to look askance at the realistic and spectacular treatment of the holy writ.

The earliest vernacular play is the Norman *Adam* written apparently in the 12th century; and the earliest examples of *Miracles* date in the 13th. The typical *Miracle* was a dramatic adaptation of a saint's life with the intercession of the Virgin on behalf of the suffering saint. In French drama, the miracles are to be distinguished from the *Mysteries*, which dealt with stories from the Bible and which ran to inordinate length, the entire Bible history being treated in a cycle of short scenes. These cycles in France were huge conglomerates, that of the Acts of the Apostles extending to 62,000 lines and occupying 40 days for its performance. In England no distinction was made between miracle and mystery, miracle becoming the generic name, although few plays based on saints' lives occur. After the institution of the Corpus Christi celebration, miracles came into the hands of the town guilds, the cycle to be performed being divided into small plays and each assigned to a particular guild. Four great collections exist, the York plays (48 in number), Towneley (32), Chester (25) and Coventry (42), all dating in the 14th or early 15th century. Each follows the scriptural story from Creation to Judgment Day. There were also other cycles and many separate plays, and the performance of plays by guilds extended to nearly every town of importance in England.

In Italy in place of miracles there were *Sacre Rappresentazioni*, and in Spain and Germany the development from the liturgical to the full-fledged miracle or mystery did not differ greatly from that in England or France. Only in France did the drama depart extensively from religious themes, both in the secular mysteries and also in farces of which 'Pathelin' is the best example. In spite of the sameness and artlessness of the religious drama, certain elements of development are manifest. A desire to bring the story home to illiterate audiences led to, both realistic and spectacular enforcement; and the addition of episodes furnished a needed comic relief and gave opportunity for some inventiveness. Another tendency, not so clearly progressive, was didacticism which combining with the fondness for allegory led to the *Morality*, a presentation of a moral lesson through personified abstractions. Apart from its allegory, however, the morality was an advance in requiring invention of plots and in centring the interest on a moral conflict.

The Renaissance.— The mediæval drama had reached a stage that held some promise of further development, when the revival of classical learning introduced entirely foreign elements and immensely hastened dramatic progress. In the conflict and amalgamation of these humanistic and mediæval elements, modern drama had its origin. The mediæval drama, mainly religious in theme, servile in its adherence to sources, ignorant of any distinction between a narrative and a dramatic fable and blind to the absurdity on the stage of much which might be essential in a story, permitted the presentation of all kinds of action and delighted in discordant combinations of the comic and the tragic. Against such a drama, the humanists protested and opposed their knowledge of the classics, the rules and proprieties of which they sought to impose on the theatre of their day. Their models, however, were not the Athenians, but Seneca in tragedy and Plautus and Terence in comedy; and their imitations lacked the authority of great masters as well as suitability to current theatrical conditions. The classical influence proved powerful, not through direct imitations, but rather in modifications of mediæval forms and methods, in widening the range of subjects, and most of all in encouraging innovation and experiment. The last of the 15th and the whole of the 16th centuries witnessed in the various nations of Europe this conflict between mediævalism and humanism in the drama as in other fields of literature and life. Neo-Latin plays, vernacular imitations of Seneca and Plautus, miracles, moralities, interludes and farces, every variety of form, jostled together and led at last to recognized standards and great achievement. In Spain and England, especially, national dramas arose that carried on mediæval traditions, though with much indebtedness to classical fecundation.

Italy.— Though Italy, as the home of the Renaissance, was the first of European nations to experience a revival of the drama under

humanistic influence, the varied imitations and experiments of the 15th and 16th centuries failed to result in a national drama of importance. The *commedia dell' arte,* comedy of masks, continued to hold popular favor, and the *rappresentazione sacra* had an early successor in Politian's 'Orfeo' (1502); but in the main the mediæval forms were discarded. Neither tragedy, though attempted by Trissino, Dolce, Giraldi Cinthio and others of international reputation in their own day, nor comedy, which attracted to its services Aretino, Machiavelli and Ariosto, achieved, with a few exceptions, either literary or dramatic excellence. More distinctly national in character and of wider influence on other literature than either tragedy or comedy was a new dramatic *genre,* the pastoral. It had an early beginning in Politian's 'Orfeo,' and the 'Aminta' of Tasso and 'Il Pastor Fido' of Guarini created a dramatic form for the pastoral tradition so powerful in the Renaissance.

In the 17th century tragedies and pastoral plays continued in abundance, but not until the 18th century was the Italian drama again of European importance. Maffeo's 'Merope' (1714) attracted European recognition, and the operas of Apostolo Zeno and Metastasio attained literary rank and vast popularity. The *commedia dell' arte,* which had spread beyond Italy and was maintaining itself in Paris, took a new departure in the dramatized fairy tales of Carlo Gozzi (1720–1808). Meantime Goldoni revived classical comedy of manners, waged war on the *commedia dell' arte* and won for himself the title of the Italian Molière. The tragedies of Alfieri (1744–1803) also won a European reputation and resulted in a continuance of classical tragedy. This achievement of the 18th century was largely under the influence of French taste, and the reaction to other models was felt in Italy as elsewhere under the impulse of the Romantic movement. The influence of Shakespeare, perceptible in the classic tragedies of Monti and Foscolo, became marked in the Romantic innovations of Manzoni (fl. 1820). During the middle of the century the popular plays of Pietro Corsa illustrate the general progress in technic, and at the close of the century the work of D'Annunzio and others gave new promise for the poetic drama.

Spain.— The Renaissance resulted in a more complete survival of mediæval conditions of the drama in Spain than in any other nation of Europe. The imitative attempts of the humanists made little impression on the public; and the real founder of the Spanish theatre, Lope de Rueda (fl. 1558), though not uninfluenced by classic and Italian literature, was a practical playwright who wrote for small traveling companies and adapted the current mediæval forms to please the taste of an illiterate public. Most notable of his dramatic forms was the *paso,* an interlude presenting some simple incident. He had numerous successors, including Juan de la Cueva, who declared open warfare against Seneca and chose national themes, and the great Cervantes, who wrote plays without much success. Toward the end of the 16th century the great period of the Spanish drama begins with the career of Lope de Vega. In the course of his lifetime the theatre was firmly established at Madrid, professional activity improved, the national characteristics of the drama determined, and the plays of Lope awarded a popularity greater than that ever won by any dramatist before or since. The number of his plays almost passes belief, rising perhaps to 1,800 full-length plays without counting many shorter entertainments, and it is on record that he composed an entire play in a single day. His work is consequently marked by carelessness and repetition; it is often hardly more than improvisation, but criticism itself is breathless when it considers the variety of his invention and the cleverness of his technic. He made use of every kind of subject, religious, heroic, romantic or realistic; and attempted with success every form of current drama, tragedy, history, miracle, morality, pastoral, and most notably of all, the *comedia de capo y espada,* the cloak and sword play. The use of the "point of honor" as a motive in these plays of gallantry and intrigue, the importance given to women in the action and the employment of the *gracioso,* a comic servant of the type of which Sancho Panza is the great representative, are a few of the contributions due mainly to Lope's invention; but it is useless to analyze his contributions to a drama that he practically made anew.

The height of Lope's activity was at the beginning of the 17th century, and the great period of Spanish drama continued until the death of Calderon in 1681. In Calderon the national drama reached its acme. Less of a creative genius than Lope and inferior to him as a playwright, he had the advantage of a generation of theatrical and dramatic progress and he possessed great genius as a lyric as well as a dramatic poet. The themes of loyalty to the king, devotion to the Church and the point of honor receive greater emphasis in his hands than they had before; in fact, a narrowness of motives and a sameness of character detract somewhat from the dramatic power of his plays. Perhaps his genius is the most characteristically displayed in his *autos,* brief allegorical expositions of the miracle of transubstantiation performed on Corpus Christi day, and late successors of the old religious drama.

In the 18th century the Spanish drama, like that of the rest of Europe, came largely under the influence of French taste and models, though not until French dramatists had found inspiration in the plays of Spanish masters. Moratín was the most successful follower of Molière; and in opposition to French supremacy, Ramón de la Cruz composed some hundreds of farces or *sainetes,* very like the old *pasos.* In the 19th century the romantic movement made itself felt in the drama, and the *Don Alvaro* of the Duque de Rivas achieved a triumph in 1835 similar to that of *Hernani* in Paris. Later in the century José Zorrilla was perhaps the most popular of dramatists, and at the present day the plays of Echegaray have attracted international interest.

France.— Although in the Middle Ages, both the religious and secular drama received a higher development in France than in any other nation, yet in the 16th century the influence of Italian humanism turned French men of letters away from national to classical models. The comic drama indeed continued, but in tragedy the Senecan exotic was for the time triumphant. Jodelle's 'Cleopatre' and 'Didon' were strict

imitations of Seneca, retaining even the choruses; and the plays of Garnier and Montchristien, highly esteemed by the literati of Europe, were similarly misdirected efforts. Toward the end of the 16th century Alexander Hardy, a skilful playwright, made use both of the national drama and of Spanish romanticism and gave vogue to the genre of tragi-comedy and established the rhymed Alexandrine as the verse to be employed henceforth in the drama. Hardy's plays aided in interesting people of culture in the professional theatre and were followed by a generation of dramatic activity.

A well-established theatre and a cultivated audience consequently awaited the arrival of a great dramatic poet. Corneille's (1606–89) first play of importance, the 'Cid,' was based on a Spanish original and, though constructed with admirable coherence and condensation, did not adhere to the three unities. For this it was censured by the French Academy, recently instituted by Richelieu, and henceforth Corneille adopted their cramping limitations. French tragedy by his powerful example was thus committed to the form exampled by Seneca and defined by the Italian humanists though usually the chorus was abandoned. A certain gain in simplicity of plot and conciseness of treatment was thus obtained at the expense of a narrowing of incident and an artificiality of characterization. Corneille dealt with heroic deeds, exalted character, noble sentiments, extraordinary situations. Racine, who followed him, chose less unusual stories, simplifying the action even more than Corneille, and excelled in the analysis of passion. Love is the dominant motive in his plays and the heroines are the persons for whom he seeks our sympathy. Melodious and dramatic as his verse is, it carries an impression of artificiality, at least to foreigners, perhaps largely on account of the conventionalized language demanded by the courtly and sophisticated audiences to which he appealed. French tragedy represents the elegance of the court of Louis XIV, as English tragedy represents the stirring activity of Elizabethan England, and as Sophoclean tragedy represents the culmination of Athenian civilization.

The greatest French dramatist, however, was a writer of comedies. An actor, and a manager of a strolling company of players that finally established itself at Paris, Molière grew slowly to the full employment of his powers. His early experience taught him the means of winning his audience, and he availed himself of every known resource in strengthening his dramatic facility. The Italian comedy of masks, the plays of Plautus and Terence and the methods and themes of Spanish drama were all drawn upon by him in his conquest of every department of comedy. His masterpieces, at once triumphantly effective on the stage and most penetrating in their revelation of the absurdities and weaknesses of human nature, have a fresh appeal to every reader to-day through their humor and their philosophy, and they have remained these 200 years the unapproached models of modern comedy.

Corneille, Racine and Molière continued the great models of drama through the 18th century everywhere in Europe, and naturally most of all in France. Lesage, Marivaux and Beaumarchais were the leading followers of Molière; and the classical tragedy received new authority through the weight of Voltaire's precept and example. A new species of drama, however, arose that violated the classical restrictions on comedy and tragedy. The tearful comedy, 'Comédie larmoyante,' pathetic and sentimental, had a considerable popularity in England and France, and was sustained by the criticism and plays of Diderot. Blending with another species, the *tragédie bourgeoise*, tragedy of common life, this tearful comedy has indeed continued as a recognized species under the name of *drame*. In the early 19th century the skilful mechanism of Scribe achieved popular success without obeying the rules, but it was not until the performance of 'Hernani' (1830) that the romantic liberation from the pseudo-classical restrictions was assured. The poetical brilliancy of Victor Hugo and the spontaneous inventiveness of the elder Dumas created a romantic drama, essentially melodramatic perhaps, but at least overwhelming the pseudo-classical pretensions. During the middle of the century, when in other nations the acted drama had ceased to be a serious department of literature, it still held its own in France in the plays of the younger Dumas, Augier and others. Until the advent of Ibsen, its serious study of contemporary society offered the most hopeful sign of the reinvigoration of the drama, and its technical excellence was the model of all other theatres. More recently the varied work of many dramatists, as Hervieu and Rostand, offers evidence that French eminenee in modern drama is still to be maintained.

England.— In England, as in Spain, the humanists failed to impose upon the drama the rules supposedly based on classical precedent, but in no other nation was the classical influence a more powerful germinating force. Mediæval forms variously modified continued to survive, but in 'Ralph Roister Doister' (1552) and 'Gorbodier' (1561), comedy and tragedy appear as highly developed forms. Though similar academic attempts, especially in Senecan tragedy, followed for some years, the establishment of the first London theatre in 1576 marked the triumph of the professional companies over their amateur and academic rivals. A dozen years later the advent of a group of clever poets determined the course of the popular drama and prepared the way for Shakespeare. The genius of Marlowe (1564–1593) brought poetry to the theatre and raised the prevailing popular forms to dramatic and literary effectiveness. He remade history and tragedy with an utter disregard for classical rules and yet, in spite of the violence and spectacle with which he delighted his audiences, he made his blank verse a noble and a dramatic expression of human passions and aspirations. Kyd borrowing from Seneca the story of revenge and the accompanying ghosts and horrors created a special type, the tragedy of blood. In comedy Lyly and Greene were the most notable innovators, the former producing artificial and courtly plays, lyrical, spectacular and abounding in witty repartee, the latter introducing romantic comedy with its averted tragedy and sentimental treatment of love. In all these plays there was rarely any attempt to follow the three unities, or to restrict in any way

the presentation of the story upon the stage. The primary aim of each dramatist was to tell his story so as to please his audience, but each was also a poet, thrilled with the spirit of the years of the Armada and ardent for the glories of the new poesy.

After these innovators came Shakespeare. This is no place for even a summary of his achievement, but it may be noted that, beginning as a remaker of old plays and an imitator and adapter of the various popular types, he was throughout his career conditioned by the efforts of his fellow dramatists and the demands of the London theatres. His masterpieces are the culmination of a most varied and virile dramatic period. The most marvelous of his gifts, his faculty of expression and his knowledge of human nature correspond to the two great excellencies of Elizabethan drama, its poetry and its characterization. The blending of wit, drollery, sentiment and fantasy that makes his comedy so enchanting and the enormous range of situation and character that displays his creative genius as supreme were the outcomes of the freedom of the stage from restrictions and of the adventurous audacity with which the Elizabethan playwrights tried their hands at everything.

The development of Shakespeare's art was in a measure paralleled chronologically by the general development of the Elizabethan drama. During the last half of his career, perhaps in part from the survival of classical influences, the other dramatists were like him, freeing themselves from much of the lawless absurdity of earlier days. Foremost among the reformers was Ben Jonson (q.v.) who sought to impose on the popular drama as much as possible of classical regularity and propriety. He was at his best in a kind of drama that Shakespeare did not attempt, the "comedy of humours," plays dealing with the manners of the day; sometimes conventionalized by too close adherence to Latin models, but again, as in 'Bartholomew Fair,' transcending anything else in English drama in the humor and truth of their realism. Of the other great names of the period there is hardly space here even for mention. Beaumont and Fletcher (q.v.) possessed an extraordinary cleverness of invention and facility of expression and, like their contemporaries in Spain, relied on complexity of plot and ingenious alterations of suspense and surprise. The heroic romances of their collaboration and the lively comedies of Fletcher's later years, though long popular and influential on the stage, lacked the moral vigor that had been characteristic of the 16th century drama and thus supply one of the earliest symptoms of the decline of the drama. Under James I, indeed, the drama no longer reflected a vigorous national spirit, but rather a corrupt and immoral society, and the poets no longer felt the stimulus of a free field for exploration and discovery, but wrote under the overshadowing influence of the great masterpieces of their immediate predecessors. Massinger, Ford, Middleton, Webster, Shirley and others produced plays of great beauty and power, but their best work exhibited no marked departure from the past, and in one way or another marked a moral and artistic decline.

Though the Restoration brought in French tastes and models, the influence of the great Elizabethans continued potent. The heroic plays, written in rhymed verse and drawn from French romances and dramas, carried on the methods of the heroic plays of Beaumont and Fletcher, and the comedies, written under the inspiration of Molière, depended largely on the examples of Fletcher and Jonson. Shakespeare's tragedy, though modified and deformed to suit the taste of the day, was dominant in the theatre. Jeremy Collier's famous attack on the immorality of the stage made an end to a period that includes Wycherley, Otway, Congreve and Dryden and that rivalled the Elizabethan in the supremacy of the drama over other forms of literature. The divorce between literature and the theatre thus proclaimed has never in the centuries since been completely annulled.

In the 18th century, while French examples dictated English literary drama, they never won much hold on the theatre. Frigid imitations of the pseudo-classical form such as Addison's 'Cato' and Johnson's 'Irene' were abundant, but even these literary imitations soon began to reflect Elizabethan models. In comedy Steele's sentimental plays correspond to the tearful comedy of France, and Lillo's domestic tragedies, based on Elizabethan predecessors and of importance abroad as well as at home in breaking the classic fetters, correspond to the tragédie bourgeoise. The vogue of the sentimental in comedy was broken by Goldsmith's 'She Stoops to Conquer'; and in Sheridan's 'Rivals' and 'School for Scandal,' English comedy of manners reached a height not since surpassed. The Romantic Movement dealt the death blow to the vestiges of pseudo-classicism still surviving, but was peculiarly sterile in positive achievement. The romanticists essayed the drama, but neither Lamb, Wordsworth nor Coleridge succeeded on the stage, and Byron and Shelley wrote without the stage in view. English writers in the 19th century were too indifferent to theatrical technic to produce effective plays. Tennyson, Browning, Arnold and Swinburne have all written dramas, but they belong to the hybrid "closet drama" that separates itself from the stage. At present in the poetical plays of Mr. Stephen Phillips and the technically skilful studies of social conditions by Mr. Pinero we may discern signs in England as on the Continent of a revival of serious dramatic activity and of the reunion of literature and the theatre.

Germany.— The modern drama had no independent development in Germany until the second half of the 18th century, when Lessing took the lead in the attack on the prevailing French conventions. His own plays gave support to his preaching and Goethe and Schiller in their early plays followed him in turning to England and Shakespeare for inspiration. Their later dramas take high rank as literature, Schiller's 'Wilhelm Tell' and 'Maria Stuart' being perhaps the best of the romantic dramas. Most of the drama of the storm and stress period was intended for readers rather than for spectators, but the plays of Kotzebue, though with little pretensions as literature, were skilful in their adaptation to the temper of the time and to requirements of the theatre, and carried everything before them in the theatres of Europe and America. The literary drama had a host of more worthy followers through the 19th century, the career

of the Austrian Grillparzer (1791–1871) being the most notable. Recently romanticism has given way to the realism of Ibsen, and perhaps the most brilliant accomplishments of the present have come from the renewed activity in the German drama, especially in the plays of Sudermann and Hauptmann.

Scandinavia.—The Scandinavian drama first becomes of European importance in the work of Ibsen. Beginning with historical dramas following the prevailing romantic fashion, he advanced to the amazingly fantastic and original 'Peer Gynt,' and then, in self-imposed exile from Norway, produced the series of social dramas that are influencing so pervasively the theatre of the modern world. Both by their profound criticism of modern life and by their technical reforms, they seem likely to mark the beginning of a new era in the history of the drama. Written in concise, unadorned prose, free from the soliloquies and lyrics and embellishments that romanticism confirmed, they return to the simplicity and directness of the Greeks; and at the same time are as modern in technic as in the problems and the psychology that they present.

America.—America has long had a theatre of importance but not a drama. The first theatre in 1766 was followed after the Revolution by the first important acted play by an American —the 'Contract' by Royall Tyler, afterward chief justice of Vermont. William Dunlap, the first dramatist of influence, translated from the popular Kotzebue and produced many plays of his own. The visit of Kean in 1820 marked the establishment of the theatre as a social institution of importance and has been followed by frequent visits from most of the great European actors; and, since Forrest played Othello in 1826, there has been a famous succession of distinguished American actors. The drama, however, has in the main continued servile imitation of European models. After Kotzebue, Scribe and Sardou were translated or imitated here as elsewhere, and the reproduction of foreign plays to the discouragement of American authors was fostered until 1891 by the absence of any international copyright. The development of the drama in Europe during the 19th century has, however, been paralleled in some degree in the United States. There has been the same advance in technic; the same conflict between romanticism and realism, and the same powerful influence of the novel upon the drama. This last influence has been perhaps stifling rather than stimulating and has led recently to a great popularity of dramatized novels, of which 'Uncle Tom's Cabin' at least has had an international vogue. More promising for the future of a national drama has been the tendency to present various phases of American life illustrated by the success of the 'Old Homestead' and by the more worthy plays of Mr. Bronson Howard and Mr. Augustus Thomas.

The Twentieth Century.—The 20th century has witnessed a remarkable development in the drama of Europe and America, and this has been accompanied by changes in the stage presentation which may be described as revolutionary. The revolution of the theatre is still in process, and no one can say with certainty what will be its outcome. But the artistic productions of Reinhardt in Germany, Barker and others in England, have been accompanied by great popular interest in the drama and many efforts to suit the theatre to the proletariat. In the United States, the changes in the stage have lagged somewhat behind the European experiments, but they are manifest in two quite opposite directions. First, the number of "little theatres" with stage and auditorium suited to literary or intellectual drama have multiplied rapidly. Second, the giving of great spectacles or outdoor pageants indicates a step in bringing the theatre to the people. Manifestly, the old theatre of the nineties no longer suffices for the many dramatic enterprises of our day; and there is in the process of creation a new theatre far more varied and flexible, and more consonant with dramatic originality.

It is indeed a vast development of dramatic originality which has caused the theatre to change its forms and manners. Everywhere young men of imagination have been turning their talents to the drama and finding in it potentialities of popular appeal not possessed even by the novel and the short story. Undoubtedly a great influence in this modern dramatic revival has been the work of Ibsen. The stage of every country has felt the force of his inspiration and has welcomed realistic studies of current manners, intellectual discussions of social problems and symbolic interpretations of life, all of which owe something to the great Scandinavian. But the dramatic revival has not been distinguished merely by the realism, social discussion and symbolism which Ibsen initiated. Poetry has reasserted its place, and Romance has never yielded its hold on the stage. Moreover, the drama of the 20th century has by no means had a uniform international development. One of its most striking characteristics has been the reappearance of strong national peculiarities. These have been most marked in Ireland and Russia; but there is no nation in Europe where playwrights are not striving to express national peculiarities and aspirations upon the stage; and in the United States the chief merits of the new drama are its observation and interpretation of American life.

In Ireland the Celtic renaissance resulted in the establishment of a literary theatre and the appearance of a national drama distinguished by the plays of Yeats, Synge and a group of enterprising lesser dramatists. In Russia, Tolstoi, Gorky and other novelists have enriched the drama, and the stage has attracted in Andreyev a writer of fantastic but powerful originality. In Scandinavia Ibsen's pessimism has been carried on in the morbid work of Strindberg, who may perhaps be credited with bringing to the fore one of the characteristic dramatic forms of the time — the one-act play. In Germany neither Sudermann nor Hauptmann has quite realized his early promise, and in men like Fulda and Wedekind, or in the Austrian, Schnitzler, it is difficult to discover any notable advance. In French, however, among a multitude of clever and intellectual playmakers there are at least three of great international influence — Brieux, Rostand and the Belgian Maeterlinck. Brieux is a propagandist who sacrifices art to moral causes, and to special causes at that, but he has succeeded in stirring the world. Rostand and Maeterlinck are romanticists,

and the former by his poetic virtuosity, and the latter by the versatility of his theatrical experiments, have done much to maintain romance and fantasy on the modern stage. The problems of sex and the disasters of love continue to be the chief themes of continental drama, and this preoccupation with a neurotic eroticism finds its most sensational exponent in the Italian D'Annunzio, who mingles great lyrical beauty with abnormal brutality. In Spain the chief figure has been Echergaray, whose melodramatic and rhetorical romanticism was tinctured in his later works by Ibsen-like symbolism; but a swarm of plays are maintaining the popularity of the threatres.

In England Jones and Pinero, who were among the first to feel the inspiration of Ibsen, have continued to write copiously; and brilliant studies of satire and contemporary manners have been contributed by Galsworthy and Bernard Shaw, while romance and sentiment have found a notable spokesman in Barrie. Shaw's plays have been as successful in Germany as in England; and all three dramatists have found an enthusiastic public on this side of the ocean. In the United States no dramatist of international eminence has emerged, but the individual plays of Thomas, Gillette, Sheldon, Walter, Moody, Mackaye and others have given evidence that the new methods and ideas are at work. There are many signs that America will take an active part in the further advances which seem sure to distinguish the drama of the 20th century.

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DRAMA, Censorship of, official supervision of plays and stage productions in the interests of public morality. In the United States this is covered by the law governing public morals, which enables a play to be suppressed if any overt act is committed which is considered immoral. In England preventive censorship of the drama dates from the reign of Henry VIII, and under Elizabeth in 1545 the master of the revels was appointed dramatic censor. In 1624 the appointment was transferred to the lord chamberlain's office. The necessity of placing a curb upon the license of the theatre in the use of political satire led to the act of 1737 which legalized the lord chamberlain's authority and established a regular censorship which became particularly active in the early years of the reign of George III. By the provisions of Acts 6 and 7 Vict., c. 68, new plays or additions to old plays must not be acted for hire at any theatre in Great Britain until they have received the sanction of the lord chamberlain, under a penalty of $250 for each performance and the forfeiture of the building's license. This power is vested in the "official examiner of stage plays" attached to the lord chamberlain's office. The licensing of theatres is vested in the county council, and is usually exercised by the presiding justice of peace of the district.

DRAMA LEAGUE OF AMERICA, an organization founded at Evanston, Ill., 25 April 1910. Its aim is to crowd out vicious plays by attending and commending good plays and building up audiences for them through study classes, reading circles and lectures; to aid in the restoration of the drama to its honorable place as the most democratic medium for the self-expression of the people. As new plays are produced, the play-going committee attends them and reports by means of bulletins on those that conform to certain critical standards. These bulletins are sent by mail to all members of the league and to all affiliated clubs or other organizations that belong to the league. The league does not censor. If it approves a play, the members are urged to support it — if it disapproves, it remains silent. The circuit committee organizes audiences in advance of a league play in a small town so that the managers are assured of sufficient support to venture to bring to a town a play which otherwise would not have visited it. The educational department of the league is made up of experts who endeavor to introduce drama through its study courses in all study clubs of the country, to equip libraries with suitable works on the drama, in short, to create by every means a better understanding of drama. The league has made rapid progress, having now a total of 60 branches, with members in 48 States, in England, France, China, Australia and in Canada. Its total membership is 23,089, and through affiliated clubs over 200,000. The fee for direct membership for the individual is $1, for a club $2, for a supporting member $5, for a life member $100. The *Drama League Monthly,* its official organ, is published

each month except June, July and August, and is sent free to all members. Wonderful pageants have been successfully conducted in many cities under its auspices, and the League was entirely responsible for the nation-wide celebration of the Shakespeare Tercentenary with pageants and masques in over 2,000 different cities. The national headquarters of the League are in Washington, D. C.

DRAMA SOCIETY, The, a New York organization of art-loving playgoers on a basis that secures to regular members of the Society the best seats, for the best productions only, at the box-office price. There are no dues and no initiation fees. The only condition imposed is that the members yearly attend 10 productions found worthy of the intelligent playgoers, within the first month after production. By ensuring that intelligent plays receive immediate attendance and financial support, the society encourages the better forms of dramatic art. Every intelligent play receives *at once* an intelligent hearing, financial support and the very best advertising — the report of discriminating people who have seen it. Artistic plays are thus guaranteed a considerable measure of success. In this way it is ensured that more good plays are produced and that no really excellent play shall fail. Instead of attempting to organize an artistic theatre, the Society aims to organize an artistic and discriminating audience. The treasurer of the society is Mr. Thomas W. Lamont, 23 Wall street, New York.

DRAMATIC ART, Schools of. See SCHOOLS OF DRAMATIC ART.

DRAMATIC ARTS, American Academy of, a school of dramatic arts, established by Franklin Sargent in New York in 1884 and chartered by the regents of the State of New York in 1889. Its object is to train pupils for the stage. It offers a two years' course, including opportunities for public appearances. The Academy took charge of the dramatic school of the Empire Theatre in 1897. Several plays are produced annually by members of the graduating class.

DRAMMEN, drăm'mĕn, Norway, seaport at the mouth of the Drammen River, on an arm of the Christiania Fjord, 33 miles southwest of Christiania. The town, which has been practically rebuilt since the fires of 1866 and 1870, is picturesquely situated between two chains of high hills. The river divides the town into three parts which are connected by bridges. The principal manufactures are woolen and cotton goods, iron work, lumber and tobacco, and there are also several saw-mills and ship-yards. Its trade is chiefly with Holland and England. It is the second port in the kingdom for the export of timber. It also exports zinc, nickel and cobalt. Nearby are large salmon fisheries. Pop. 23,091.

DRANESVILLE, Battle of. Dranesville is on the Alexandria and Leesburg turnpike, 16 miles northeast of Washington; and 20 Dec. 1861, to collect a supply of forage near there, Gen. E. O. C. Ord, with his brigade of Pennsylvania Reserves, the First Pennsylvania Rifles, a battery of four guns and a detachment of cavalry — in all about 3,900 men, — moved from camp near Langley's. Driving a few Confederate cavalry from Dranesville, he entered it. It happened the same morning Gen. J. E. B. Stuart started from the Confederate lines at Centreville with a brigade of infantry, 150 cavalry, four guns and about 300 wagons, to gather hay near Dranesville; and he was so engaged when he heard that Ord was approaching. Fearing for the safety of his train, and believing that the only way to save it was to attack Ord, he advanced for that purpose, at the same time ordering his wagons back to Centreville. Stuart attacked with great impetuosity, and after a severe fight of two hours was defeated and retreated to Centreville, with a loss of 186 killed and wounded. Ord's loss was 67 killed and wounded. Compared with subsequent events, Dranesville was a small affair, but it gave encouragement to the Union cause and stands greatly to the credit of the Pennsylvania Reserves. Consult 'Official Records' (Vol. V).

DRAPER, Andrew Sloan, American lawyer and educator: b. Westford, N. Y., 21 June 1848; d. Albany, N. Y., 27 April 1913. He attended the public schools of Albany until 1863, when he won a prize scholarship in the Albany Academy. Upon graduating in 1866 he became instructor there, and principal of a graded school, through the next four years. During these years he had been reading law, and, after graduating from the Albany Law School and the School of Law of Union University, he was admitted to the bar in 1871, and practised in Albany till 1887. In 1881 he was elected to the legislature, and for several years was actively engaged in politics. In 1884 he was appointed by President Arthur one of the judges of the United States Court of Alabama Claims, serving until the duties of that court were concluded.

It is, however, for his long and distinct service to the administration of American education that Dr. Draper is best known and appreciated. From 1878–81 and again from 1890–92 he was a member of the board of education in Albany; when in the legislature in 1881 he was a member of the committee on public education; in 1882 he became one of the board of the State Normal School in Albany; in 1886 and again in 1889 was elected, by the legislature, State superintendent of public instruction. From 1889–91 he was president of the National Association of School Superintendents; in 1892–94 superintendent of public schools of Cleveland, Ohio; in the latter year resigned this position to become president of the University of Illinois, acting in that capacity for 10 years; in 1902 was appointed by President Roosevelt a member of the United States Board of Indian Commissioners; in 1903 was elected president of the North Central Association of Colleges and Secondary Schools, and on 9 March 1904 was chosen commissioner of education of the State of New York. He was chairman of the Department of Education of the International Congress at Saint Louis 1904 and was awarded the grand prize of the exposition for the preparation of educational exhibits from Illinois and New York. Dr. Draper wrote largely on historical and educational matters and in 1905, beside contributing many articles himself to the work, became editor of the educational department of the 'Encyclopedia Americana.' (See article EDUCATION). A large bronze memorial tablet to Dr. Draper

was unveiled at the 53d convocation of the University of the State of New York in the State Education Building in Albany on 18 Oct. 1917. Among his numerous publications are 'How to Improve the Country Schools' (1887); 'Powers and Obligations of Teachers' (1887); 'School Administration in Large Cities' (1888); 'The Indian Problem in the State of New York' (1888); 'History of the New York Common School System'; 'Legal Status of the Public Schools' (1890); 'The Authority of the State in Education' (1890); 'A Teaching Profession' (1890); 'American Schools and American Citizenship' (1891); 'The Spirit of the Teacher'; 'Science in the Elementary Schools'; 'The Pilgrims and Their Share in the National Life'; 'American Universities and the National Life'; 'The Illinois Life and the Presidency of Lincoln'; 'The Rescue of Cuba'; 'Bankers and the Community Life'; 'John Marshall and the March of the Constitution'; 'Memorial of President McKinley'; 'Coeducation in America'; 'The Personal Equation in the Medical Profession'; 'The Recovery of the Law'; 'The University's Return to the State'; 'The Element of Inspiration in the Schools'; 'Educational Tendencies, Desirable and Otherwise'; 'University Questions concerning the Common Schools'; 'Organization and Administration of American Educational Systems'; 'Conserving Childhood' (1909); 'Holiday Papers' (1912), etc. He was also editor-in-chief of 'Self-Culture for Young People' (10 vols., 1906).

DRAPER, Daniel, American meteorologist: b. New York, 2 April 1841. He studied science under his father, J. W. Draper (q.v.), acting as his assistant and amanuensis for years. He helped his brother, Henry Draper, to construct the telescopes, grind the mirrors and build his observatory at Hastings-on-the-Hudson. From 1869 to 1911 he was director of the New York Meteorological Observatory, the self-recording instruments in use there being of his design. He has written a 'Treatise on the Causes of Pneumonia' and also helped his father in the preparation of his 'History of the Intellectual Development of Europe.'

DRAPER, Eben Sumner, American manufacturer and political leader: b. Hopedale, Mass., 17 June 1858; d. 9 April 1914. He received his education at the Massachusetts Institute of Technology, became a member of the firm of George Draper and Sons in 1880 and selling agent of the Draper Company in 1896. He acquired interests in several manufacturing corporations and was chosen president of the Manville Company and vice-president of the Massachusetts Hospital Life Insurance Company. He took an interest in politics, was chairman of the Republican State committee in 1892 and of the Massachusetts delegation to the Republican National Convention of 1896. He was a presidential elector in 1900, was lieutenant-governor in 1906–08 and governor of Massachusetts in 1909–11.

DRAPER, Henry, American scientist: b. Prince Edward County, Va., 7 March 1837; d. New York, 20 Nov. 1882. He is a son of J. W. Draper (q.v.). He studied in New York from 1852 to 1854 and began the practice of medicine in 1858. He was then professor of physiology in New York University from 1860 to 1866, professor in the medical school from 1866 to 1873 and afterward professor of chemistry. He constructed large telescopes and devoted himself to celestial photography, rendering important service to astronomy and astrophysics. The continuation of his spectroscope investigation of the stars which was cut short by his death was provided for by the endowment of the Draper Memorial at Harvard Observatory by his widow in 1886. He published 'On the Construction of the Silvered Glass Telescope' (1864; 1904), and 'A Text-book on Chemistry' (1866).

DRAPER, John Christopher, American physician: b. Prince Edward County, Va., 31 March 1835; d. New York, 20 Dec. 1885. He was graduated from the medical department of New York University, was professor of physiology in that institution 1858–60 and professor of chemistry in the medical department 1866–85. He was also professor of chemistry at Cooper Union and professor of physiology and natural history at the College of the City of New York. He edited the 'Year Book of Nature and Science' (1872–73) and for three years edited the natural science articles in *Scribner's Monthly*. He wrote 'Production of Urea' (1856); 'On Respiration' (1856); 'Text-book on Anatomy, Physiology, and Hygiene' (1866); 'Practical Laboratory Course in Medical Chemistry' (1882); 'Text-book of Medical Physics' (1885).

DRAPER, John William, American physiologist and chemist: b. Saint Helens, Lancashire, England, 5 May 1811; d. Hastings-on-the-Hudson, N.Y., 4 Jan. 1882. He obtained his early schooling at Woodhouse Grove in a Wesleyan Methodist institution and then took up courses in chemistry, physics and higher mathematics under a private tutor. In 1833, when 22 years of age, he came to the United States and entered the University of Pennsylvania, there taking a course in medical studies and graduating with his degree of M.D. in 1836. Shortly after graduating he received an appointment to the chair of chemistry, natural philosophy and physiology in Hampden-Sidney College in Virginia, continuing in that capacity until 1839. It was then that he commenced the experimental researches which rendered his name famous, and during those years he contributed the results of his experiments to the *American Journal of Medical Sciences*. In 1839 he was called to the chair of chemistry and natural history in the academic department of the University of New York and also gave lectures on physiology to the more advanced undergraduates. In 1841 he became professor of chemistry in the University Medical College and in 1850 professor of physiology. Draper made many improvements in the art of photography. Following out the principles as invented by Daguerre in 1839, he commenced experimenting along the same lines and became the pioneer of photography in America; and it was he who first applied photography to the portrayal of the human face, his first photograph being that of his daughter, taken in 1839. He also discovered and described "misers' images" or roric figures and about the same time applied the use of ruled glasses and specula to the study of chemical action of light.

Dr. Draper's writings were numerous, among the most important of them being 'A Treatise on the Forces which Produce the Organizations

of Plants' (1844), in which the author demonstrates that the most intense action of sunlight is produced by yellow rays; 'Text-book on Chemistry' (1846); 'Text-book on Natural Philosophy' (1847); 'Human Physiology, Statical and Dynamical of the Conditions and Course of the Life of Man' (1856); 'History of the Intellectual Development of Europe' (1862), a work of great importance and very widely read, later being translated into 10 languages, the purpose of the book being to show that social advancement is as entirely dominated by natural law as is bodily growth; 'History of the American Civil War' (1867–70); 'History of the Conflict between Religion and Science' (1875). His collected works were published in 1878, entitled 'Scientific Memoirs, Being Experimental Contributions to a Knowledge of Radiant Energy.'

DRAPER, Lyman Copeland, American historian: b. Hamburg, N. Y., 4 Sept. 1815; d. Madison, Wis., 26 Aug. 1891. He removed to Wisconsin in 1853, became corresponding secretary of the State Historical Society, and it was mainly through his efforts that the State secured its library and its important antiquarian collection. He published 'Collections' of the State Historical Society (10 vols., 1853–87); 'Madison the Capital of Wisconsin and its Heroes' (1857); 'King's Mountain and its Heroes' (1881).

DRAPERY. See COSTUME.

DRAPIER LETTERS, a series of letters published by Dean Swift over the signature M. P. DRAPIER in 1724. They were called out by the proposal to impose upon Ireland a debased coinage from which a court favorite and a king's ministers were to get the profit. The opposition to the action excited by these letters defeated the project and gave Swift a reputation he never lost. See also SWIFT, JONATHAN.

DRAUGHTS. See CHECKERS.

DRAVE, drä'vē, or **DRAU,** a European river which rises in Tyrol, flows east-southeast, part of its course between Hungary on the left and Croatia and Slavonia on the right and after a course of 400 miles joins the Danube 14 miles east of Essek. It is navigable for 200 miles.

DRAVIDIAN, a term applied to the people who inhabited the southern part of what is now India previous to the advent of the Aryans, and also to the language spoken by these same people. The Dravidian languages are generally considered to belong to the Turanian class — a family of languages said by some authorities to include all the Asiatic languages in general, outside the European and Semitic families. The Dravidian languages include the Tamil, Telugu, Canarese, Maylayâlam, Tulu, Tuda, Gond, Rajmahal and Oraon. There are other minor subdivisions made by some authorities. Only the first four mentioned have a literature. The Dravidians now occupy the greater part of the peninsula of India. The Tudas, or Todas, in the region of the Nilgiri Hills, belong to the lowest of civilized people or races, while among the Tamils are found many who have attained a high place in literature.

The Dravidians proper are quite distinct from the Aryans, but they have been assimilating with those around them, so that now among them may be found traces of the Caucasians, and their literature partakes much of the Aryan culture; but they have kept their speech comparatively pure for centuries. In the southeastern part of the peninsula and in Ceylon live those who speak the Tamil; estimated to be about 18,130,000 people. North of the Tamils, and on the east, are the Telugus, 23,540,000 in number. The Canarese is spoken by about 10,530,000 people who live in the western part of the peninsula; and the Malayâlam by about 6,790,000 people who live in the southwestern part of the peninsula. The Dravidian population totals 62,720,000.

In the Tamil and Telugu languages there are a number of excellent literary productions; not all original, some are modeled on or adapted from the Sanskrit. Two of the poems which may be traced to at least the 10th century — but which the Tamils claim are much older — are the 'Kintamani' and the 'Naladiyar.' The latter has been translated by Pope. The Tamils claim also that Agastya lived before Christ and that he was the first teacher of science and literature. In about the 12th century, the poet Kambar made, in Tamil, an adaptation of the Sanskrit poem 'Ramayana,' one of the two great epics of India; and in the 16th century the poet Ati-vira-Rama Pandya, a native king, wrote works of merit. The Tamil poet Tayumanavar wrote in the beginning of the 18th century; and at about the same time an Italian missionary, a Jesuit named Beschi, wrote in the Tamil both prose and poetry. The work of this literary priest has done much toward directing the attention of Eastern scholars to the Tamil language and literature.

The oldest poem extant in Telugu language is a version of the Sanskrit poem, the 'Mahabharata,' the other of the two great epic poems of India. This poem was written in the Telugu by Nannaya Bhatta, in the 12th century. A poet named Cesava of the 12th century wrote in the Canarese. In the Malayâlam there is one poem based upon the Sanskrit, an account of Rama, a heroic prince who belonged to a royal house of India. There are also versions of both the 'Mahabharata' and the 'Ramayana.' Consult Arden, 'Grammar of the Telugu Language' (Madras 1873); Brown, 'Dictionary of Telugu' (Madras 1852–54); Caldwell, 'Comparative Grammar of Dravidian' (2d ed., London 1875); Carr, 'Collection of Telugu Proverbs' (Madras 1868); Dalton, 'Descriptive Ethnology of Bengal' (Calcutta 1872); Graul, 'Tiruvalluoer's Kural' (Leipzig 1865); Haltzsch, 'South Indian Inscriptions, Tamil and Sanscrit' (Leipzig 1890–95); Hunter, 'Dictionary of the Non-Aryan Languages' (London 1868); Kingscote, 'Folk-Lore of Southern India' (London 1890); Oppert, 'Original Inhabitants of India' (London 1893); Pope, 'First Lessons in Tamil' (Oxford 1891); Reclus, 'Primitive Folk' (New York 1890).

DRAW BAR PULL. See LOCOMOTIVE.

DRAW-LOOM. See DAMASK.

DRAWBACK, in common law, an allowance or rebate made by the United States government to merchants on the re-exportation of certain imported goods, liable to duty. This drawback in some cases consists in the surrender of the whole duties collected on the goods; in other cases, only a part of the duties paid on the importation is returned to the

importer. Goods can thus be sold in a foreign market at their natural cost in the home market.

DRAWBRIDGE, a bridge with a lifting or sliding floor, such as may be used for crossing the ditches of fortresses or may be constructed to cross navigable waters where the height of the roadway is insufficient to allow vessels to pass underneath. There are various kinds of drawbridges. One is the lifting bridge, which is raised bodily on one end. For fortifications this is the kind commonly employed, the platform forming or strengthening the gate when raised. For detailed history see *Movable Bridges* under BRIDGE.

DRAWING, Art, Pictorial Representation and Decorative Design. See ART DRAWING.

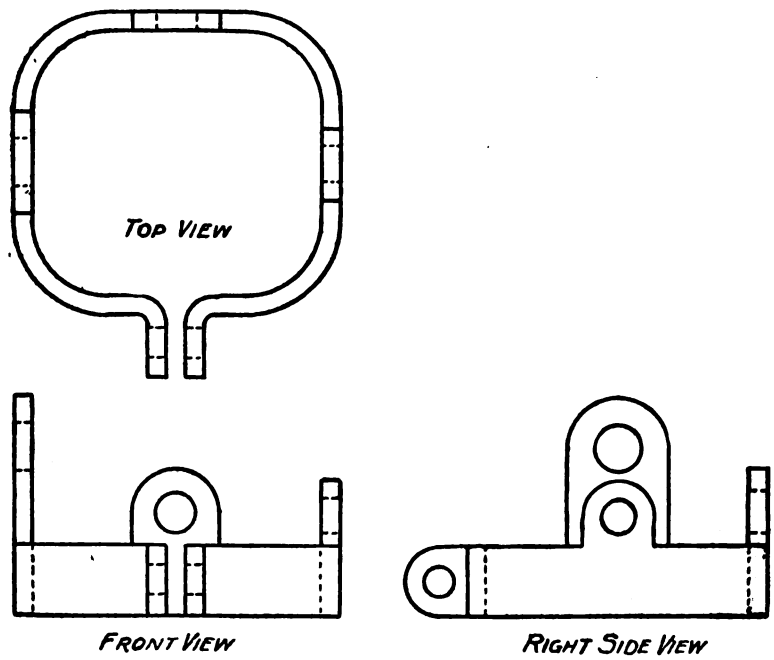

FIG. 1. — Third Angle Method.

DRAWING, Mechanical, the art of representing objects on paper, or other flat surface, by means of projections of the objects on imaginary planes. A drawing of this sort is executed with the aid of instruments, such as compasses, scales, T-squares, triangles, etc., especially designed to facilitate its production. The projections of the objects are areas of the imaginary planes which represent the object and are obtained by drawing imaginary lines from the points of the object to the planes. These imaginary lines may meet in a point or be parallel. In the former case the representation obtained on the plane is a conical projection of the object; in the latter, the projectors may be either perpendicular to the plane of projection, giving us orthographic or orthognal projection, or oblique to the plane of projection, giving us oblique projection.

Drawing made on the principle of conical projection is known as perspective drawing and is the basis of all artist's work. This is used chiefly, in a technical way, by architects in making preliminary sketches, in studying problems in design and in showing clients the finished appearance of a proposed building. Perspective is, however, unsuited for working drawings as it does not aim to convey precise detailed information. The term, mechanical drawing, often indicates the type of drawing used in the industrial world by engineers and designers to express and record the ideas and information necessary for the construction of machines and structures. This type of drawing may better be called engineering drawing. Through it the draftsman, using orthographic projection, gives exact and positive information regarding every detail of the proposed machine or structure. By this graphic means any operation may be minutely described and a complete record kept for duplication and repairs. This constitutes a graphic or written *language*. It can be read only by forming a mental picture of the subject represented. Skill in this *language* is indicated not alone by execution but by the ability to interpret impressions by visualizing clearly in space. The training this interpretation gives in quick, accurate observation and in the power of reading description from lines has a value not understood by those unfamiliar with it.

The principal lines of most buildings, machines and structures are generally in three directions: one vertical, the other two horizontal and at right angles to each other. The object is placed in the first or third angle of space, with these principal lines or dimensional axes parallel to the planes of projection. The position of the projections called «views» in engineering drawing correspond to the positions assumed by these views when the planes of projection

are revolved into the plane of the paper. Since the object is placed with its principal lines or dimensional axes parallel to the planes of projection, each view shows two dimensions of the object in true size; and any line which runs in the direction of the third dimension is represented by a point. Likewise, any surface in the direction of the third dimension will be represented by a line. If the plane of projection is parallel to the front of the object the resulting projection is called the front view and shows the dimensions of height and length. If parallel to the top or bottom of the object the view shows the dimensions of length and depth. The former is called the top view and the latter the bottom view. If the plane is parallel to a side of the object it is called a side view, which shows the dimensions of height and

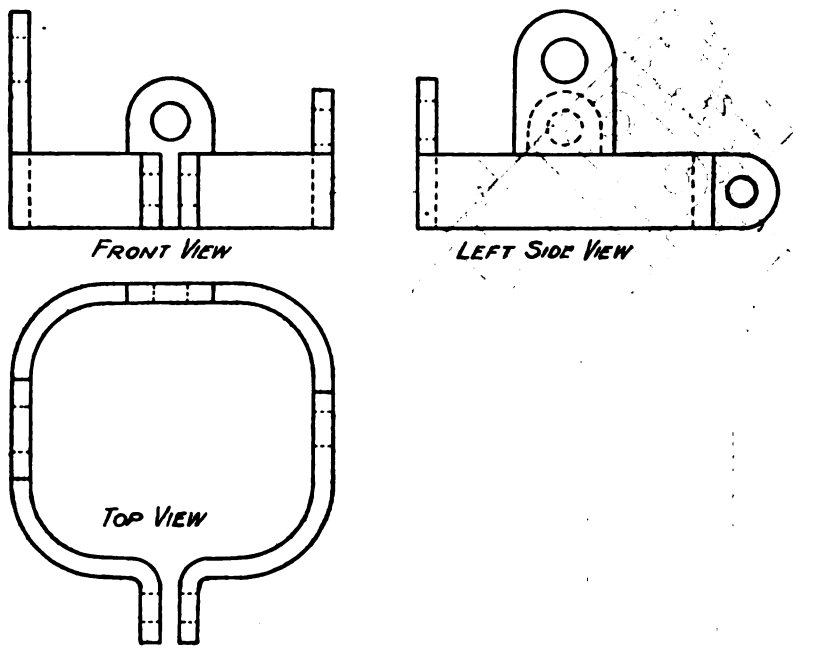

FIG. 2. — First Angle Method.

depth. Any combination of two or more adjacent views may be used to express the object.

It is the manner of arranging these views which determines whether the drawing is made in accordance with first or third angle projection. The former method was abandoned in this country more than 25 years ago and is now almost obsolete. It is occasionally met in old drawings and in foreign drawings and therefore should be understood.

Figs. 1 and 2 show an object made of sheet metal drawn according to first and third angle methods of mechanical drawing.

In both, the following principles are evident: the top view is directly over or under the front view; the side views are in the same horizontal line as the front view and the width of the side views is the same as the width of the top view.

An object is sometimes composed of a combination of units whose dimensions are in different directions and can be shown to better advantage by combining some of the other views with one taken on a plane so placed as to show the dimension of the part not shown in the regular views. Usually it is not necessary to project the entire object on this auxiliary plane, but only the part to be shown in true shape. (See Fig. 3, which is a detailed drawing of a bearing bracket). It is often not possible to show the internal construction of an object clearly by using dotted lines to express the invisible parts in an outside view. In such cases the object is drawn as if parts were cut or broken away. Such a view is called a «section.» (See Fig. 4). In it the exposed portions of the cut surface are indicated by section lining, composed of diagonal lines, usually at 45 degrees and spaced uniformly to give an even tone. It must be understood that the portion sectioned to show the interior in one view is *not* removed from the other views, but is indicated on the view to which the cutting surface is perpendicular, by a broken line consisting of alternate long and short dashes. When a figure is symmetrical along an axis, half only may be sectioned and the other half shown in an outside view. This shows in one view what would otherwise require two.

Working drawings are drawings which give all the information necessary for the complete construction of the object represented. They are divided into two main classes, assembly drawings and detail drawings, which are generally made in accordance with the principles of orthographic projection.

An assembly drawing shows the object with all its parts in their proper positions. A few of the principal dimensions are given and the parts may be indicated by distinguishing marks

or numbers which serve as a guide to the erector. The over-all dimensions are serviceable in determining the space required. Detail drawings give minute particulars regarding the form and construction of each part of the machine and must be made clearly to be self-explanatory.

All dimensions should be accurately shown (Fig. 3) and it must be borne in mind that the dimensions given are those necessary and most convenient for the workman who is to make the piece. Therefore, the draftsman must put himself in the place of the pattern maker, blacksmith or machinist and must mentally construct the object represented. He must foresee whether the object can be cast or forged practically and economically and must know which dimensions would give in the best way the required information.

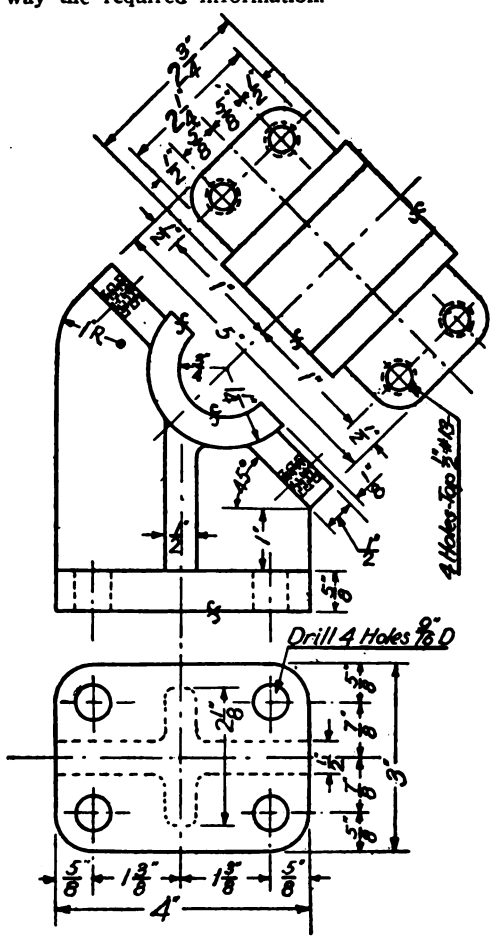

FIG. 3.

Since a complete record of the work is necessary, original drawings are never allowed to leave the drafting-room but the drawings are duplicated by tracing in ink on transparent paper or cloth and a photographic print is made on sensitized paper. Any number of prints may be made from one tracing. The tracing is the "master drawing" and must never be taken from the office.

All unnecessary labor in drafting should be avoided. The drawing should give the instructions explicitly, but should not be so elaborate as to require a waste of time in its execution. Accordingly, if there is a way of representing an object by a few lines, without sacrificing clearness, that method should be used. There are many details such as screw threads, springs, bolts, rivets, gear wheels, etc., which occur so frequently in working drawings, that easy methods of representation, or conventions, have been universally adopted.

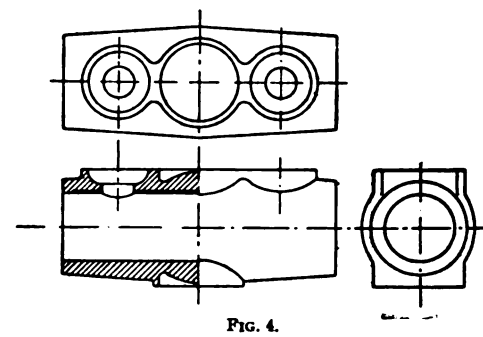

FIG. 4.

The steps to be taken in making a working drawing may be summarized as follows: (1) Pencilling on paper.

(a) Choice of views — Make only as many views as are necessary to describe the object. Some thought will be involved as to which view will show the object to the best advantage: whether a section will explain the construction better than an exterior view; whether an auxiliary view will save one or more other views.

(b) Choice of scale and size of paper — Since the drawings are to be filed for reference it is necessary to establish some sheets of standard size, which would determine the scale.

(c) Block in all views and take care that the location of views on sheet will allow for title and notes.

(d) Complete outline.

(e) Dimension.

(f) Add section lines, notes, title, border, trimming line. (2) Tracing on cloth.

(a) Stretch cloth on pencilled drawing. Dust with chalk or prepared pounce and rub off with a cloth to remove any traces of grease which sometimes prevents flow of ink.

(b) Ink all circles, arcs, irregular curves.

(c) Ink-in horizontal lines with T-square and vertical lines triangle. Work from top to bottom and left to right.

(d) In this order ink-in inclined, dimension, extension and centre lines; arrow heads, figure, notes, title, section lines and border.

Before sending to the shop, a working drawing must be checked for errors and omission, by an experienced checker.

To be effective the checking should be done systematically and with thorough concentration which allows nothing to distract attention. Observe this method: (1) Be sure that the views completely represent the object to be constructed and that they are properly arranged with respect to each other, according to the third angle method; (2) check all dimensions by scaling, and where advisable also by calcu-

lation. Dimensions of parts which go together should be compared. Also see that there are no interferences with adjacent parts and that proper clearances have been allowed. This is especially true in connection with mechanical movements, which should be laid out to scale so that the clearances are maintained; (3) the dimensions should be given as required by the shop; that is, the shop should not be obliged to add or subtract to obtain any dimensions; (4) the proper finish marks $\sqrt{}$ should be indicated and likewise the character of the finish designated; (5) all the necessary specifications of materials should be correctly given; (6) all small details, screws, bolts, pins, keys, rivets, etc., should be standard and where possible stock sizes should be used; (7) the title or record strip should be checked to make sure that it contains in complete yet concise form all necessary details; (8) in connection with any points that have suggested themselves during this checking, the drawing should be reviewed in its entirety; (9) add any explanatory notes which from experience will enhance the efficiency of the drawing; (10) before placing your initials in the title space and assuming the responsibility for the accuracy of the drawing answer the question, "Am I willing to sign this drawing as checked?"

Several kinds of one plane projection which result in a conventional picture have been devised, so that the pictorial effect of perspective drawing is combined with the possibility of measuring directly the principal lines.

The third dimension is shown by turning the object in such a way that three faces are visible. Although these methods of representing objects have pictorial advantages their usefulness has some limitations. The representations are distorted until the appearance is often unreal and unpleasant. Only certain lines can be measured

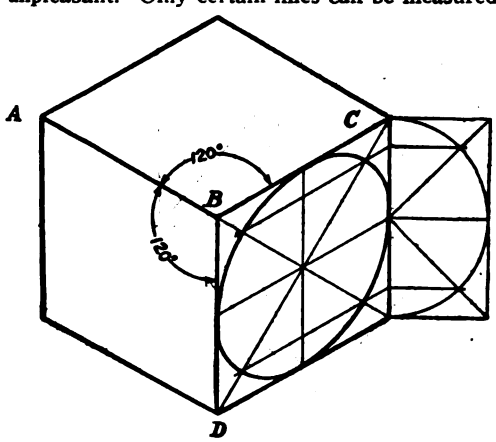

FIG. 5.

and the execution requires more time, particularly if curved lines occur. Nevertheless these methods are often used to great advantage in technical illustrations, patent office drawings, piping lay-outs, etc. The simplest of these systems is isometric drawing. If a cube is considered to be placed with one of its diagonals perpendicular to a plane, the edges of the cube will make equal angles to the plane of projection; and if an orthographic projection of the cube is made on the plane, the projection of the edges will be equal in length. The projections of the three edges which intersect (AB, CB, DB) at B will make an angle of 120 degrees to one another, as shown, Fig. 5. These lines are called isometric axes and are parallel to the directions of the three dimensions of the object. The representations of edges which are parallel to these in space will be parallel to the isometric axes and are called isometric lines. In this projection all the lines have been shortened owing to the fact that they make angles to the plane of projection. If this foreshortening is disregarded and the full lengths laid off on the axis, the figure will be slightly larger but of exactly the same shape. This is known as isometric drawing and is used almost exclusively instead of isometric projection. It has the advantage of measuring the lines directly with ordinary scale, and the increased size is usually of no consequence. Lines not parallel to one of the isometric axes are called non-isometric lines. Measurements can be made only on isometric lines. If a non-isometric line is to be drawn, it must be drawn by reducing it to a system of isometric co-ordinates. In this way curves of any shape may be constructed.

Oblique Projection (see Fig. 6), sometimes called cavalier projection, is based on the principle that one face of the object is placed parallel to the plane of projection. The projectors

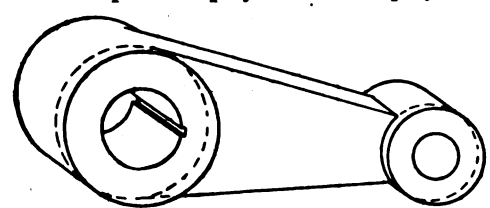

FIG. 6.

make angles of 45 degrees with it in any direction. Thus lines perpendicular to the plane of projection will be projected in their true length. Oblique projection is similar to isometric drawing because it has three axes representing three mutually perpendicular lines; upon these lines measurements can be made, and two of the axes will always be at right angles to each other and will represent lines parallel to the plane of projection. The third axis may be represented at any angle, but 30 degrees is generally used. One face of the object will be represented without distortion. This is one of the advantages of oblique projection over isometric, particularly in representing objects with circular or irregular outlines. There are general rules in connection with drawing of this sort: First, place the object so that its irregular outline or contour will be parallel to the plane of projection; and second, if possible have the longest dimension parallel to the plane of projection.

Axonometric Projection.—The principle of isometric projection was shown to be based on the orthographic projection of a cube whose axis is perpendicular to the plane of projection. The cube might be placed in any other position with respect to the plane of projection, so that its projection would show three faces, and the angles and proportionate foreshortening of the

axes used as a basis for a pictorial representation. This system is known as axonometric (or axometric) projection. This is the general

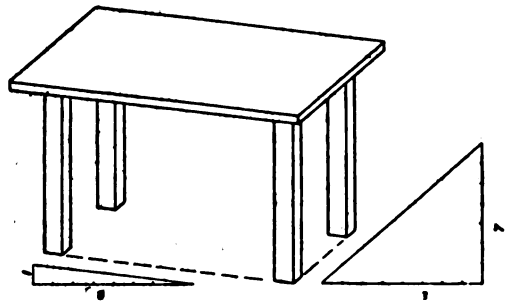

FIG. 7.

system and it will be noticed that isometric projection is a special case in which the axes are foreshortened equally. When two axes are equal and the third unequal the system is called "dimetric" projection, an example of which is shown in Fig. 7. Here the ratios are 1 : 1 : ½ and this makes the tangents of the angles one-eighth and seven-eighths as shown.

Other positions of the object, which would show less distortion, can be found but are not often used because there is greater difficulty in execution.

In drawing the crystal figures in mineralogy a system known as "clinographic" is used. This is based on oblique projection. The object is placed with its vertical axes parallel to a vertical plane of projection; and it is rotated about this axis until the horizontal axes make angles to the plane of projection, whose tangents are respectively one-third and three. The object is then projected on the vertical plane of projection, as shown (Fig. 8), by profile lines which make an angle to the plane of projection whose tangent is one-sixth. The result is a pleasing representation of the object.

Machine Design.— A machine is a combination of mechanical movements constructed to transform energy directly or indirectly from natural sources into useful work. The design must be thought out with a view toward the economy of this transformation together with the economic manufacture of the machine. It may therefore be stated that machine design is a problem involving the proper co-ordination of the following elements: *Required work;* available power; mechanism or kinematic motion; performance and limiting proportions; the nature and magnitude of the stresses acting on the various members of the machine; the materials and proportions of the several members, as determined by the particular stresses; wear; stiffness; methods of manufacture and other commercial conditions, such as the interchangeability of parts to reduce the cost of both manufacture and maintenance; the general arrangement as required for erection, easy repair, oiling and adjustments.

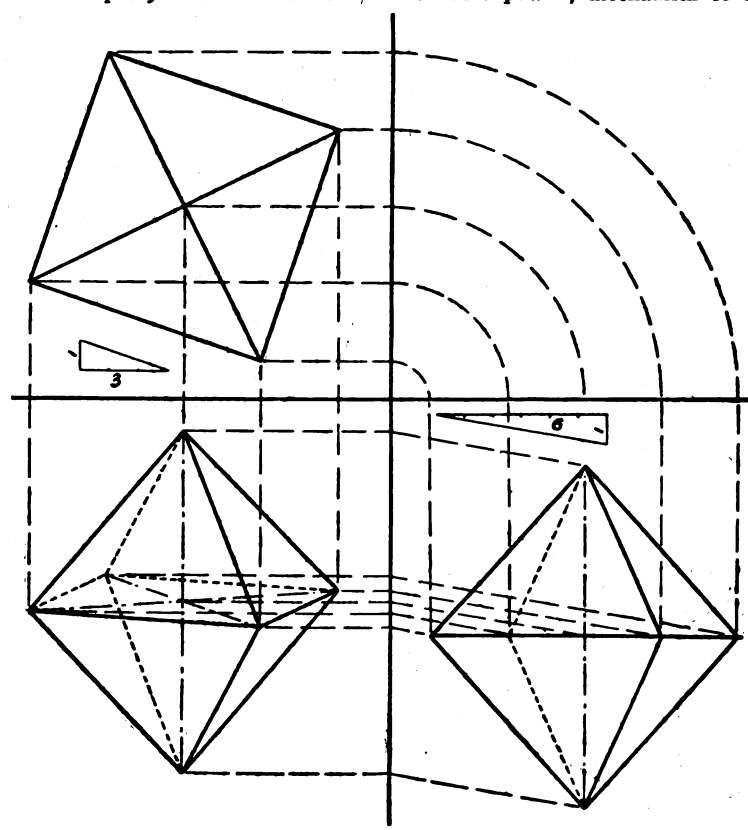

FIG. 8.

There are, of course, no set rules which can be laid down for the method of procedure in completing the design of a machine, but there are right and wrong ways of attacking the problem, and since the same principles of design are applicable to all machines the following general plan of solution is given.

1. Given — (a) Kind of work to be done.

(b) Power available, steam, gas, electric or hydraulic and the method of application of the power to the machine, i.e., whether belt or direct.

(c) Capacity and limiting proportions.

1. Determine the kinematic train with which to connect the available power so that the required work may be produced with a minimum energy loss. The design and selection of a combination of material elements so connected that motion in any one involves definite, relation, constrained motion of the others for a given machine, is governed by the manner in which the energy is supplied and the character of the work to be performed; for the energy may be supplied in one form of motion and the work done with quite a different one. If a mechanism which will accomplish the desired results already exists the problem is one of selection and arrangement of parts. But if a new type of machine is desired or a new mechanism necessary, the problem may become one of the nature of invention. While it is true that the mechanism can usually be designed without reference to the energy transmitted it is necessary to analyze the kinematic energy cycles before any *definite dimensions* of the parts of the mechanism can be fixed. Furthermore as stated above the methods and available facilities of construction control the design to a certain extent. Lay out the centre lines of the machine according to the above determinations and check for limitations of motion, interference, etc.

2. Clothe the mechanism decided upon in metal by determining the general form of the elements and the materials best suited for their construction together with the allowable working stresses. Complete the sizes of such parts of the mechanism as a simple layout will permit. Lay out the principal joints of the mechanism. When mechanisms are enclosed build from the inside out. Don't design the frame first and try to put the mechanism inside, the frame must conform to the mechanism.

In many cases the forces acting on the machine element are very complex, owing to any combination of the following conditions:

(a) Transmission of force from one element to another.

(b) Internal restraint due to circumstances in manufacture.

(c) Restraint due to energy transmission.

(d) Forces due to the inertia of moving parts.

Therefore the theoretical design is not always clear and our knowledge of materials and their laws is limited in many respects so that in many cases we must rely on judgment and empirical data, the result of experiments. Even where the conditions are clear the design must always be controlled by practical modifications and construction considerations. The designer must therefore be a man of judgment, thoroughly familiar with the production of machinery, and the relation thereto of the allied commercial departments so that he may give each factor its proper weight and obtain the best results at the least possible cost.

The last step, specification and drawing, is a necessary and important supplement to the process of design. It is a powerful aid to the mental process of the designer and is the best and easiest way of showing the workmen how the machine is to be constructed, and also of making a record of what has been done. The drawing is not machine design itself, as machines may be designed and built without drawings. It is, however, an essential part of the designer's equipment because the mere act of putting the results of his thought on paper is one of the greatest helps to force systematic and definite thought.

Design which stops short of exact working drawing is only half done. In fact the crucial test of practicability of a piece as part of a machine is the possibility of its being exactly detailed. It is more easy to generalize than to get down to exact detail and there is nothing more productive of trouble, delay and waste of time and money than poor detail drawings.

Very often written specifications to accompany the drawings are not only useful but necessary, and as the writing of these specifications presupposes a most intricate knowledge of design and selection of materials, the highest skill of a designer is often needed clearly and fully to specify in writing just what is to be done.

The actual process of drawing in the development of a design may be outlined as follows: Rough sketches merely representing ideas, not drawn to scale, are made to determine the mechanical ideas concerned in the design. These are followed by layout drawings in which the design is developed and the general detail established. This drawing contains the principal dimensions to fix and control the detailed design. Each part of the machine is then detailed and a working drawing showing every small detail of its shape together with dimensions and specifications is made so that the workman may be definitely informed as to its construction. Assembly drawings are then made and constitute the last step in the representation. They show the parts assembled in the complete machine. The layout mentioned above may be finished up into an assembly drawing, but it is usually safer to make the latter a separate drawing, as changes in detail are often necessary, and it will serve a valuable aid to the draftsman in checking up the dimensions of his detail drawings.

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DRAWING-BOARD, a board on which paper is strained for water-color painting. It is made of a flat piece of wood held together and

prevented from warping by an edging of other pieces, the grain of which runs in an opposite direction. The drawing-paper is first dampened and then attached to the edges of the board with thin glue, gum or paste, and when dry becomes perfectly tight and flat. In charcoal or crayon drawing the board is used, but the paper is merely pinned on the board.

DRAYTON, Michael, English poet: b. Hartshill, Warwickshire, 1563; d. London 1631. His first appearance as an author was in 1591, by the publication of 'Harmony of the Church, Containing the Spiritual Songs and Holy Hymns of Godly Men, etc.,' followed in 1593 by 'Idea, the Shepherd's Garland,' and 'Roland's Sacrifice to the Nine Muses,' a series of eclogues. In the same year appeared his 'Legend of Piers Gaveston,' and in 1594 his 'Matilda.' Drayton's great poem is his 'Polyolbion' (1613), a sort of topographical description of England. It is generally extremely accurate in its details, with, at the same time, many passages of true poetic fire and beauty. It is frequently, however, tedious and obscure, and its extreme length is sufficient to deter many from undertaking its perusal. The gem of Drayton's poems is his 'Nymphidia, the Court of Fairy,' edited by Sir E. Brydges in 1814. His other works comprise several historical poems, such as the 'Barons' Wars' (1603, first issued in 1596 under the title 'Mortimeriados'); 'England's Heroical Epistles' (1597); the 'Legend of Great Cromwell' (1607); the 'Battle of Agincourt' (1627); besides numerous legends, sonnets and other pieces. He was buried in Westminster Abbey, where there is a monument to his memory. His complete works appeared in 1748. Morley published selections from his 'Poems' (London 1878). Consult Elton, 'Introduction to Dayton' (Manchester 1895), and 'M. Drayton, a Critical Study' (London 1906).

DRAYTON, Thomas Fenwick, American military officer: b. South Carolina about 1807; d. Florence, S. C., 18 Feb. 1891. He was graduated at the United States Military Academy in 1828, and resigned from the army in 1836. He entered the Confederate army upon the outbreak of the Civil War and played a prominent part during the attack on Fort Royal, commanding a force in Fort Walker which he was forced to evacuate.

DRAYTON, William, American jurist: b. South Carolina 1733; d. June 1790. He was educated for the bar in the Middle Temple, London, where he studied four years. He returned to America in 1754, and was appointed chief justice of the province of East Florida in 1768. During the war of the Revolution he was suspended from his office and reinstated in it, and went with his family for a time to England. After the peace he became successively judge of the Admiralty Court of South Carolina, associate justice of the State and a judge under the Federal government.

DRAYTON, William, American politician: b. South Carolina; d. Philadelphia, 24 May 1846. He was a representative in Congress from South Carolina from 1825–33, and in 1830 was a leader of the Union party in opposition to that of nullification. He resided in Philadelphia many years prior to his death, and in 1839 succeeded Nicholas Biddle as president of the United States Bank, the affairs of which he found it impossible to retrieve.

DRAYTON, William Henry, American statesman: b. Drayton Hall, S. C., September 1742; d. Philadelphia, 3 Sept. 1779. He was educated in England at Westminster School and at Baliol College, Oxford. Returning to America in 1764, he became an active writer on political affairs and published letters on the side of the government, which brought him into controversy with Christopher Gadsden and other patriotic leaders. As the Revolutionary crisis approached he espoused the popular cause. In 1774 he was appointed judge of the province, and when the Continental Congress was about to sit he published a pamphlet under the signature of "A Freeman," which substantially marked out the line of conduct pursued by the Congress. In 1775 he was president of the Provincial Congress, and in 1776 was elected chief justice of South Carolina. He was a member of the Continental Congress from 1778 till his death. His 'History of the Revolution' appeared in 1821 in greatly expurgated form. His son, John Drayton, governor of South Carolina in 1800–02 and 1808–10, based his 'Memoirs of the American Revolution Relating to the State of South Carolina' (Charleston 1821) on the work of his father.

DREAM OF GERONTIUS, The. Cardinal Newman's 'Dream of Gerontius' is a poem of the passing of the faithful soul from earth to purgatory. Gerontius in the horror of dissolution girds himself to his last preparation among his praying friends and fades into his last sleep. The next stage, the soul passing, is a penetrating intellectual conception realized imaginatively in the separate and successive utterances of the soul and the guardian angel. The third stage, the soul passed, brings the two together in dialogue. Still conversing with the angel, Gerontius then on his way to God meets jeering demons. The final stage is expressed in the praises of angelical beings and in the soul's cry before the face of God, "Take me away, that sooner I may rise." The verse is perhaps Newman's highest achievement in variety and range. The simple stanza of "Praise to the Holiest in the height" is carried forward in successive choruses to effects of piercing simplicity. The dignity of the iambics, the weaving in of litany and psalm and the use of various stanza forms, constitute an exquisite adaptation, and the poem is no less remarkable in its total movement. It unites with exceptional power the intellectual and the emotional values of poetry. Without sacrifice of precision, theological conceptions are transmuted imaginatively into personal experiences. Infinity and purgatory pass from abstract idea into intense feeling. The poem has been set to music by Sir Edwin Elgar.

CHARLES SEARS BALDWIN.

DREAMS. These are mental activities, carried on during sleep, which are at times brought into consciousness by a process of secondary elaboration. They are as necessary a part of the brain's activity as is the movement of the heart or the storage of glycogen in the liver, functions of these two other organs respectively. All people dream during sleep, but not

all the dream activities come into consciousness. In some the memory of the dreaming is very distinct. In others it is less so. Careful attention to the subject shows the universality of the dream phenomena, and modern investigation is showing that the functional activity of the brain during sleep is of equal if not greater importance than the same activity during the waking state. The dream is the index or the mode of activity of the unconscious. Logical thinking, so-called, that of the conscious.

Cabanis, in his 'Rapports du Physique et du Moral de l'Homme,' says of Condillac, that he often brought to a conclusion in his dreams reasonings on which he had been employed during the day, and which he had not completed when he went to bed; and of Franklin, that that wise and enlightened man believed that he had been often instructed in his dreams concerning the issue of events which at that time occupied his mind.

Coleridge thus describes the circumstances under which the fragment called Kubla Khan was composed: He had fallen asleep in his chair while reading in his Purchas' 'Pilgrimage' of a palace built by Khan Kubla, and remained in that state for about three hours; during which he could not have composed less than from 200 to 300 lines, if that can be called composition in which all the images rose up before him as things, with a parallel production of the correspondent expressions, without any sensation or consciousness of effort. On awaking he instantly sat down to commit the poem to paper. After he had written the lines subsequently published, he was interrupted for a time, and when he returned to the task the poem had vanished from his memory. These are illustrations, by no means rare, of the fact that the real creative capacity of the brain is largely an unconscious product.

Viewed superficially, dreams are wanting in coherency; all probabilities and possibilities of time, place and circumstance are violated. Nothing is more common than for the mind in dreams to combine objects and events which apparently could have had no associated existence. The faces of friends long since dead and events long since past rise before us sometimes with more intense vividness than in real existence and cause no surprise by their incongruity.

The rapidity with which the dream takes place is also remarkable. We may seem to live a weary lifetime in the dream of a minute; the sprinkling of a few drops of water on a gentleman's face was accompanied by a dream in which the events of a whole life passed before him, ending with a protracted struggle on the borders of a lake into which he was plunged. The whole process must have taken place in a second or two, as the dreamer was aroused from sleep by the application of the water. Some authorities declare that all our dreams take place when we are in process of going to sleep or becoming awake, and that during deep sleep the mind is totally inactive. This is denied by the majority of philosophers, and with apparent reason.

Freud, one of the most acute and painstaking of all of the students of the dream phenomena, has truly stated that all men are great in their dreams. The dream is the primary creative art. Its great rapidity is due to the fact that in the unconscious all of the individual's life accumulated experiences are on view, as if in a cinematographic flash. The stream of the unconscious contains the entire urge of the individual's life, which when it would come into consciousness is immediately blocked off and only a tiny jet of it, as it were, permitted to pass beyond the portals into consciousness. It is a brain function to push back almost the entire force of this accumulated impulse and permit only a little of it to enter into real action —i.e., to do useful work. By useful here is meant the purposeful work demanded by the rules of the herd.

The dream is a fragment of this great urge of the individual's inside activity, hence Freud called it a wish-fulfilment, as Heraclitus, the original pragmatist, did 500 B.C. This Greek philosopher truly said, "For the waking there is one common world, but for those asleep, each one retires to his own privacy. And do you imagine we could do with impunity what we dream? Is it not because we lie still and do not act we can indulge our fantasies?" This statement of Heraclitus very cleverly sums up the chief activities of the dream process, namely, that it is a compensation in fantasy for what is denied the individual in reality, hence it is a great balance wheel for cultural repression. The dream seems chaotic and meaningless, however simple, because it is expressed by a special type of symbolic thinking. All thinking is symbolic, but ordinary logical thinking proceeds along conventionalized and disciplined community thinking. It is thinking which deals largely in terms of herd agreements. Dream thinking is highly individualistic and only deals with primitive types of resemblance. It is related to animistic thinking. It is guided largely by individual egotistic strivings and like any foreign language needs a key for its interpretation. Since the two primary wishes which have ever been present in all living matter have been to live and to reproduce, a rigid application of such a formula to the dream will bring out the nature of its wish-fulfilling fantasy of the individual, hence any dream may be said to contain a medley of these two motives. It may not be possible to construct a full measure of the dream wish from the fragment which is remembered because this remembered fragment presents only a much distorted, revamped account of the primary wish activities of the patient. One can understand a dream by picturing to oneself an inverted cone. From the bottom of this cone a stream of feeling arises. This feeling stream is unharnessed, undirected, it is just plain urge of the individual's organic cravings. But such cravings need outlets, and in some kind of action, so as the cravings, which are highly dynamic, rise more and more insistently for expression, they catch up symbolic forms of things through which they can express themselves. They become dramatized as it were, and thus the feelings get related to ideas and to objective forms. As the dream is intensely creative, the objects first chosen may not be considered consciously eligible for expression, hence a form of camouflage takes place — these are technically termed in psychoanalytic literature distortions or displacements, condensations or secondary elaborations, so that by a process of caricature the original cravings

come to a process of expression in a form which the cultural level of the individual will permit. This completed product is termed the *manifest content* of the dreamer. It is the elaborated, modified caricature of the original type of striving, distorted, and may be rendered almost unintelligible to the dreamer. Yet it has done its work. It has helped to conserve sleep and discharged the energy which lay behind the craving.

Children's dreams are apt to express their cravings with but little symbolic distortion. As the individual grows up, however, these more childish strivings take on more definite character, but in the dream are subjected to greater and greater distortion. Hence in most adults the wish is much modified in its presented and presentable form. All dreams mean something. It may not be possible to find out, or it may not be worth while, but it is certain that they have a physiological function just as much as does respiration, circulation, digestion, etc. The analysis of these latter functions is still very imperfect, so also is the analysis of the dream function. Human knowledge of human activities is still far from satisfactory, but in dream comprehension a great advance has been made by recent psychoanalytic investigation. For the literature to 1917 and full discussion, consult Jelliffe, 'Technique of Psychoanalysis' (*Nervous and Mental Disease Monograph Series*, New York and Washington).

SMITH ELY JELLIFFE.

DREBBEL, Cornelis van, Dutch philosopher and inventor: b. Alkmaar, North Holland, 1572; d. London 1634. He lived in London from the year 1620, devoted entirely to scientific labors. He invented several philosophical instruments, among which, it is said, were the compound microscope and a thermometer consisting of a glass tube containing water connected with a bulb containing air. His contemporaries say that he displayed to King James a glass globe in which by means of the four elements he had produced perpetual motion, and that by means of machinery he imitated rain, thunder, lightning and cold, and was able quickly to exhaust a river or lake. He discovered a bright scarlet dye for woolens and silks which was introduced into France by the founders of the Gobelin manufactures; and the invention of the telescope has been ascribed to him, but on no good grounds. Drebbel left treatises which appeared first in Dutch (1608), and afterward in Latin, under the title 'Tractatus duo: De Natura Elementorum; De Quinta Essentia' (1621). It was also translated into French (1673).

DREBER, Heinrich, known as **Franz-Dreber,** German painter: b. Dresden, 9 Jan. 1822; d. Anticoli di Campagna, near Rome, 3 Aug. 1875. He began his art education at the Dresden Academy, and became a pupil of Ludwig Richter whose idealistic style he copied. He went to Rome in 1843 at the expense of the Dresden Academy. Two of his pictures are in the Berlin National Gallery, namely, 'An Autumn Morning in the Sabine Mountains'; and 'The Hunt of Diana.' A landscape, with the figure of the 'Good Samaritan,' is to be found in the Dresden gallery.

DRED, A Tale of the Great Dismal Swamp, a novel by Harriet Beecher Stowe, published in 1856. It belongs to the literature of the slavery agitation in the United States, and deals with the experiences of a fugitive slave. It is also called 'Nina Gordon.'

DRED SCOTT CASE, the most far-reaching slavery case ever in the United States courts. Dred, born in Missouri about 1810, was a slave of Dr. Emerson, an army surgeon, who took him in 1834 to Rock Island, Ill., and May 1836 to Fort Snelling, Wisconsin Territory (now Minnesota), where he married Harriet, a slave of his master, and had two children. Slavery was illegal in both places: in Illinois by its constitution, in Wisconsin (upper Louisiana Purchase) by the Missouri Compromise. In 1838 he was taken back to Missouri — Saint Louis.

Here in 1848 was living the eminent free-soil lawyer, Francis P. Blair, Jr. He learned of Dred's migrations, and wishing to test the right of slavery to reclaim persons once free, induced Dred on being whipped by his master to sue for assault and battery in the State Circuit Court of Saint Louis County. Blair and his free-soil friends furnished funds and legal assistance. The suit was sustainable only if Dred was a free citizen charging violence from another citizen; and the court held that his residence on free soil had made him free, and there was no legal power to re-enslave him. Appeal was taken to the supreme court of Missouri, which reversed the decision; the two associate justices against the chief justice decided that Emerson had only made a temporary change of domicile in obedience to government orders, that his property was held according to the laws of his permanent domicile, and that Scott's servile character was merely in abeyance and fully resumed on return to Missouri; refused to consider the Illinois constitution or the Missouri Compromise as relevant, and sent back the case to the Circuit Court.

Meantime Emerson had sold Dred and his family to John F. A. Sandford of New York and suit was brought against Sandford for assault and battery in carrying off Scott — this time in the Federal Circuit Court for Missouri, on the constitutional ground that he was a citizen of a different State from Sandford. Sandford denied jurisdicion on the ground that Dred was not a citizen but "a negro of African descent," progeny of negro slaves. Dred's counsel demurred (admitted the facts but denied their sufficiency), claiming that being a negro did not prevent his being a citizen; the court sustained him. Sandford denied assault and battery, claiming that he only "gently laid hands" on him to coerce him, as was his right toward a slave; the court instructed the jury that this was law; Dred's counsel took exception, and the case went up to the United States Supreme Court.

It was argued at the December terms of 1855 and 1856. Montgomery Blair (brother of Francis P.) and George Ticknor Curtis (brother of Judge Curtis) were counsel for Scott, Reverdy Johnson and Henry S. Geyer for Sandford; all gratuitously. Justice Nelson prepared a brief abstract of the decision; but the

public excitement over the slavery question was so intense and menacing to the Union (just after the Buchanan-Fremont election), that it was decided to have Chief Justice Taney write a full and careful review of the whole law on the subject of slavery, in hope of making the members of the free-soil party accept it contentedly and cease their agitation. Taney and six assistant judges concurred against Scott; Curtis and McLean dissented.

The written decisions were withheld from the public till 6 March 1857, two days after the inauguration, to avoid embroiling Pierce's last months. The decision proper was essentially the same as that of the Supreme Court of Missouri; that Dred Scott as a negro was not a citizen of the United States within the intent of the Constitution, and therefore the Circuit Court had no jurisdiction and the suit should be dismissed. This decision remained United States law, an irremovable barrier in the way of granting civil rights to the colored race, till the passage of the Fourteenth Amendment (see CONSTITUTION — Amendments).

Unfortunately, the court did not confine itself to the case before it; but for the reasons above mentioned, and to answer for the public the arguments brought forward by counsel, who went out of their way to deliver a series of *obiter dicta* (personal judgments not needed or relevant for the case in hand, and therefore not law), which inflamed the public wrath immeasurably as a fresh aggression of the slave power, have remained in public memory as the only interesting points in the case, and are, in fact, by far the most important aspects of it. These were three: in essence, that African negroes had never been recognized in American law or custom as persons; that Congress had no power to make regulations for the Territories acquired after the Constitution was adopted, except under the Constitution, which recognized slaves as property; and that the Missouri Compromise, already repealed by the Kansas-Nebraska Bill, had never been constitutional. (1) Of course no exception had been taken by Scott's counsel to the circuit court's ruling that negro blood was no bar to citizenship; but the Supreme Court dragged it in and overruled it. In the counsel's statement of the condition of public opinion at the time of framing the Constitution, they used a phrase which is immortal in public memory, and usually supposed to be their own decision as a point of present law; that negroes were then regarded as "so far inferior that they had no rights which the white man was bound to respect," and to be rightfully made slaves for white men's benefit. The court held that they were regarded in the Constitution as only chattel property; were not included in the words "people" or "citizens" in the Declaration of Independence, the Articles of Confederation or the Constitution, remained in this condition of civil nullity even when emancipated, had no rights except such as each State chose to grant them, and could not become citizens capable of suing and being sued. The dissenting judges pressed the notorious distinction between citizenship and suffrage (See CITIZEN); called attention to the Constitution's repeated mention of the negroes as "persons," and to the fact that free negroes were actually voters in five of the States in 1787, and were so even yet save where the States had changed their Constitutions to disfranchise them; and held that the civil rights of free negroes were the same at least as those of women and minors. (2) As to the Territories, the *obiter* decision was that as the Constitution admitted slaves to be property, and by the Fifth Amendment Congress had no right to take away any citizen's property without compensation, it had no right to make laws barring slave property from the Territories more than any other; that its rules and regulations must be in conformity with the Constitution. The dissenting judges held that both by common law and the Constitution slavery was a purely State institution (cf. Art. IV, § ii, par. 3: "No person held to service or labor in one State," etc.), sustainable only by State law and State police power of quelling resistance; that once out of the State's power, a slave instantly became free by the law of nature, and that State law could not follow him to the Territories. (3) The decision that the Missouri Compromise was unconstitutional, as interfering with the natural right of a slaveholder to take his property where he pleased, and with the constitutional equality of citizens of different States, followed from the court's opinion on the second point. The dissenting justices held that the Compromise was a rightful exercise of the constitutional power of Congress to legislate for the Territories, and never before questioned since the government was founded; and that it did not violate the equality of citizens because citizens could only hold slave property in States that permitted and enforced it.

The whole question was soon decided by the war. Scott and his family were inherited by Calvin S. Chaffee of Massachusetts (then in Congress), were conveyed by him to Taylor Blow of Saint Louis for emancipation, and were emancipated 26 May 1857. Consult decision in Howard's 'Report . . . in the Case of Dred Scott' (1857); Benton, 'Examination of . . . the Dred Scott Case' (1860); Corwin, 'The Dred Scott Decision in the Light of Contemporary Legal Doctrines,' in *American Historical Review* (Vol. XVII, 1911); Tyler, 'Life of Taney' (Baltimore 1872); Curtis, G. T., 'Life of B. R. Curtis' (Boston 1880). The Missouri Historical Society has a portrait of Scott, from a photograph.

DREDGE, a machine for excavating mud, rock, or other solid material from the bottom of a body of water. Essentially the dredge consists of a scoop of some sort to pick up the material to be excavated, and a derrick-like mechanism to lift the scoop with its load up to and above the water level, and dump it. There are many ingenious modifications of this essential idea, by which the movements of a shovel, of a grasping hand, or of an ice-tongs are imitated with great precision and with immense power at points 40 feet below the water level. The machinery which operates the dredge is built upon a scow or boat which is floated over the place where the work is to be done. The dredge is held in position by heavy posts called "spuds' which go down loosely through openings in the deck of the scow and rest on the water bottom. There are usually three of these, two at the shovel or bow end

of the dredge and one (sometimes two) at the stern. The bow spuds are much larger, having to withstand the strains of the working shovel. In some large dredges the bow spuds are built-up timbers upwards of 40 inches square and over 50 feet long, with a heavy iron shoe at the bottom. To the shoe is bolted a "foot" of timber covering an area of 10 by 12 feet to give a substantial bearing on a soft mud bottom. To add to the grip on the bottom some dredges have tackle attached to the bow spuds by which the scow may be hoisted upon them above its natural floating level, thereby shifting a part of the weight of the dredge and its machinery upon the spuds, and thus pressing them down the more firmly. When the dredge has finished the work it can reach from one position, the spuds are raised clear of the bottom, and the machine is moved by a tug-boat, or by pulling on chains attached to anchors.

Dredges are of two general classes: intermittent, and continuous. The former operates a single bucket or scoop, and alternately digs and lifts the load; the latter digs continuously, raising the material at the same time. To the intermittent class belong the dipper dredge and the grapple or grab dredges. To the continuous class belong the ladder dredges, the hydraulic or suction dredges and the scouring dredges.

Dipper Dredge.— The dipper dredge is similar to the steam shovel used in earth excavation on land, except that it is worked from a float, and that the dipper or bucket is much larger — up to 15 cubic yards capacity. The dipper dredge is the type almost universally in use in the United States, and is effective in depths of less than 50 feet of water, and in the greatest variety of bottom material. It will dig economically in stiff clay, hardpan and even soft rock. For such work the dipper is armed with teeth of appropriate size and shape, and a small bucket is used. Generally the material raised is placed upon a scow moored beside the dredge. In some instances the handle of the dipper has been lengthened so that the spoil may be dumped upon a nearby bank. With a dipper of six cubic yards capacity the output of one of these dredges warking in ordinary earth is about 5,000 cubic yards per day of 10 hours.

Grab Dredges.— These are of two models, with, respectively, the clam-shell bucket and the "orange-peel" bucket. The former has a bucket composed of two great scoops which close together at the bottom like the valves of a clam-shell. They are hinged at the top. They are spread wide open as they descend, close upon the material at the bottom, and remain closed as the bucket is lifted until released to drop its contents upon the scow tender alongside. The orange-peel bucket is of hemispherical shape, divided into three or four sharp, curved triangular sectors, resembling the sections of peel removed when peeling an orange in the usual way. The orange-peel bucket is not much in use in the United States, but the clam-shell dredge is of the greatest usefulness in many locations, particularly for picking up chunks of broken rocks, and for excavation in water too deep for the dipper dredge. The buckets have to be very heavy, as there is no other force but their weight to drive them into the material they have to dig. One advantage which the grab bucket has over the dipper is the speed with which it gathers its load and drops it. The largest of these buckets have a capacity of 12 cubic yards, and their output on a long job averages about one bucket per minute, two-thirds full.

Ladder Dredge.— The ladder dredge operates an endless chain to which many buckets are attached, the chain traveling around a ladder-shaped frame, hinged to the superstructure of the vessel at the top. The lower end of the ladder may be dropped down until it touches the bottom, and the chain of buckets is then run at high speed, scooping up the material of the bottom as the dredge moves forward — usually under its own motive power. The buckets have a capacity of about one cubic yard and are raised at a speed of 16 per minute. The dredged material is carried to the top of the ladder and is there dumped into chutes which discharge it into scows alongside; or it may go into hoppers constructed in the hull of the boat itself. Another modification for canal work provides long discharge troughs by which the material is delivered on the canal banks. The ladder dredge is extensively used in mining operations in the streams of Alaska, California, South America, Siberia and South Africa, digging up the gold-bearing sand and gravel from the creek bottoms and landing it on the dredge where the gold is recovered and the waste returned to the stream. Tin and platinum are recovered in the same way.

Hydraulic Dredge.— The hydraulic dredge sucks up the material of the bottom by means of a powerful centrifugal pump. Where the bottom is hard a revolving cutter head is attached to the inlet pipe of the pump and this breaks up the bottom and mixes it with the water so that it will be of the right degree of fluidity to flow readily through the pump — about 15 parts of water to one part of solid material. The cutter head may be pushed ahead of the vessel on a boom dragged by a flexible suction pipe. The hydraulic dredge works well in sand, gravel, alluvial deposits and earth free from stones larger than eight inches diameter and from stumps, piling and similar obstructions. It has a special field in bottoms so light that the dipper and bucket dredges simply stir them up without lifting them. The discharge of the hydraulic dredge being in large part water, requires a particular method of disposal. Sometimes a long pipe line is laid from the dredge to a point on shore where the spoil may spread out and settle into solid land as the water drains away. In this way much marsh land is filled in and made available for use, and the cost of the dredging not only recovered but a substantial profit secured. In some cases the dredge float has hoppers into which the discharge is poured, the solid matter settling and the water running out at the scuttle holes. Sea-going dredges of this type are used for harbor work. When their hoppers are full they sail 8 or 10 miles out to sea and dump them.

Universal Dredge.— This title is given to large sea-going dredges which are fitted with both the ladder with its endless chain of buckets and a great hydraulic pump and pipe line. Some of these vessels are of the dimen-

sions of small steamships, with hoppers capable of carrying 2,500 cubic yards of dredged material.

Scouring Dredge.—The scouring dredges are simply submersible harrows, scrapers and agitators used to stir up light silty bottoms and bars so that the natural current of the stream may carry the material to a point where it is not objectionable. The same result has been attained by the use of water jets and aëration with compressed air.

Dredges are employed in some cases in land excavations, a pool sufficient to float the dredge being artifically formed, water being supplied to preserve the pool level as the digging proceeds. This method has been successfully used in digging irrigation canals in the arid regions of the Western States. Along the Mississippi and Ohio rivers dredges are used to secure sand and gravel for commercial purposes, the hydraulic dredge being used for sand, and the ladder dredge for gravel. Incidentally the river channels are improved, as the operations are conducted under the directions of government engineers. Consult Fowler, C. E., 'Practical Treatise on Sub-Aqueous Foundations' (New York 1914); McDaniel, A. B., 'Excavating Machinery' (New York 1913); Prelini, C., 'Dredges and Dredging' (New York 1911).

DREDGING, the operation of removing mud, silt and other deposits from the bottom of harbors, canals, rivers, docks, etc., by mechanical means. The most simple dredging apparatus is the spoon apparatus, which consists of a strong iron ring or hoop, properly formed for making an impression upon the soft matter at the bottom, so as to scoop it into a large leather bag attached to the ring and perforated with a number of small holes. The means for working it is a long handle, a suspending rope, and a crane or sweep-pole planted in a boat. This primitive apparatus was formerly used in the canals and ditches of the Netherlands. Much more effective is the steam dredging-machine now in common use. It is said to have been first applied by Boulton and Watt for use on the weir at Sunderland, England, in 1796. It has a succession of strong iron buckets on an endless chain running on a frame, the lower end of which is vertically adjustable so as to regulate the depth at which it works. The buckets tear up the matter at the bottom, raise it and discharge it into barges or hoppers stationed close to the dredging vessel. The Suez Canal was excavated by means of a ladder dredge with a long chute and supporting girder. The material excavated was carried in boxes on a sort of tramway and tipped out on the bank.

In excavating at Hell Gate and Flood Rock Reefs, at New York, a barge measuring 120 feet in length, 44 in beam, and 15 in depth, used a grapple which weighed 15 tons and lifted boulders of 70 tons. In some cases the current of river or tides has been utilized in dredging channels. In bottoms of mud or loose sand the steam pump or hydraulic dredger may be used. The watery material is pumped out and deposited on the shore; the water drains away, leaving the sand or mud. By this means more than 3,000 cubic yards a day can be excavated at an extremely low cost. Great improvements have been made in hydraulic dredges, and some built in recent years for use in the Mississippi River have a capacity of over 1,000 cubic yards per hour.

Dredging is also the operation of dragging the bottom of the sea in order to bring up oysters, or to procure shells, plants and other objects for scientific observation. The oyster dredge is a light iron frame with a scraper like a narrow hoe on one side, and a suspending apparatus on the other. To the frame is attached a bag made of some kind of netting to receive the oysters. The dredges used by naturalists are mostly modifications of or somewhat similar to the oyster dredge. Scientific dredging has of late assumed a high importance as making us acquainted with the life of deep-sea areas. See DEEP-SEA LIFE.

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DREIBUND, drī'bund. See TRIPLE ALLIANCE, THE.

DREIKANTER, drī'känt-ėr, or **WINDKANTER,** rudely triangular polished pebbles, which have been worn smooth by drifting sand. They may be seen in most regions of sand dunes, but especially in deserts.

DREISER, Theodore, American editor and author: b. Terre Haute, Ind., 27 Aug. 1871. He received his education at the University of Indiana, and in 1892 began his career as a journalist on the staff of the Chicago *Daily Globe*. In 1892–93 he was successively dramatic editor and special correspondent of the *Republic* of Saint Louis. His next work was on special assignments for various magazines. In 1905–06 he edited *Smith's Magazine*, and in the following year was managing editor of the *Broadway Magazine*. From 1907 to 1911 he was editor in chief of the Butterick periodicals. He wrote several magazine articles and also 'Sister Carrie' (1900); 'Jennie Gerhardt' (1911); 'The Financier' (1912); 'A Traveler at Forty' (1913); 'The Titan' (1914); 'The Genius' (1915); 'Plays of the Natural and the Supernatural' (1916). His novels are of the realistic type, eager in their psychological analyses of their principal characters. Mr. Dreiser presents American life in terms of its materialism, its lesser personalities. His descriptions are melodramatic and often cheap, but he is nevertheless powerful and vigorous and is given a high place by many modern critics. Because of his frank, often crude, handling of sex problems several of his works have been censored by the United States Press Censorship Board.

DREISSENA, drīs'sē-na, a genus of fresh-water lamellibranch mollusks of the *Dreissenidæ* family, so named from Dreyssen, a Belgian naturalist. They are allied to the mussels. *D. polymorpha,* a native of the Caspian and Aral rivers and seas, is a well-known species in the rivers and estuaries throughout western Europe, including Great Britain, where they were accidentally introduced, probably on imported timber.

DRELINCOURT, drĕ'lăn'koor', **Charles,** French Calvinistic clergyman: b. Sedan, 10 July 1595; d. Paris, 3 Nov. 1669. He was the author of many controversial works and of a book entitled 'Les Consolations de l'âme fidèle contre

les frayeurs de la mort,' translated into English under the title 'The Christian's Defense Against the Fear of Death' (1675). To promote the sale of the English translation of this work De Foe, it is said, wrote his 'Apparition of Mrs. Veal,' which was published along with the fourth edition of it in 1706. His son CHARLES (1633–97) became professor of medicine and anatomy at Leyden and was appointed physician to William, Prince of Orange, afterward William III of England.

DRESDEN, Germany, capital of Saxony, situated in a valley on the river Elbe. On the left bank are Altstadt (Old Town), Friedrichstadt and other quarters, and on the right the Neustadt (New Town) and the Antonstadt. The municipal area received a large extension in 1897. The portion on the right bank, called the Neustadt since 1732, is really the older, and was formerly known as Old Dresden. Among the structures worthy of notice are the five bridges across the Elbe, noted for their solidity, the first built in 1173; the Sophienkirche or Protestant Court Church; the Roman Catholic Court Church, which contains several fine pictures; the church of Our Lady, an imposing edifice; the church of Saint John; the royal palace; the law courts; the museum, a beautiful building containing a famous picture gallery and other treasures, and forming a wing of the building known as the Zwinger, which contains zoological and other collections; the Japanese Palace (Augusteum), containing the public library of about 570,000 volumes besides a rich collection of antiquities; the Johanneum, now containing the collection of porcelain and the historical museum, a valuable collection of arms, armor, domestic utensils, etc., belonging to the Middle Ages. The royal palace is unattractive externally, but has a fine interior adorned with frescoes, and the Green Vault contains a most valuable collection of jewels and small works of art. There is a fine park of 300 acres. The city is distinguished for its excellent educational, literary and artistic institutions, among which are the Polytechnic School with 1,500 students, organized much on the plan and scale of a university; an important military academy, Dresden being the headquarters of the 12th Army Corps; the Conservatory and School of Music; the Academy of Fine Arts; the Royal School, for drawing, modeling, etc. It is an important centre of the drama; the municipality owns three theatres; and the Court Theatre, a large and splendid edifice opened in 1878, which specializes in the adequate production of masterpieces in drama and opera, is one of the most famous in the world. The manufactures of Dresden are not unimportant and are various in character; the china, however, for which the city is famed, is made chiefly at Meissen, 14 miles distant. In Dresden are made articles in gold and silver, mathematical and surgical instruments, straw hats and plait, artificial flowers, gloves, leather, cigars and cigarettes, musical instruments, chemicals, perfumes, mineral waters, chocolate, playing-cards, etc. There are large breweries, and in the neighborhood there are coal mines, iron and glass works and manufactories of machinery, chemical stuffs, etc. The commerce is considerable and of late years, since the development of the railway system, the trade with foreign parts has considerably increased. A good deal of business is done with the upper parts of the Elbe by means of the steamers, which ply as far up as Tetschen.

The gallery of pictures, one of the finest in the world and especially rich in the works of Italian and Dutch masters, was begun very early, but first became of much importance under Augustus II, king of Poland and elector of Saxony. It owes its most valuable treasures, however, to Augustus III, a prodigal monarch, who exhausted his country by his extravagances. He purchased the greater portion of the gallery of the Duke of Modena for $900,000, and many single pictures, among them Raphael's masterpiece, the 'Madonna di Sisto.' This celebrated painting is in a room alone, no other picture being hung near it. The pictures number about 25,000 and in particular comprise many fine specimens of the Italian, Dutch and Flemish Schools. From the Dutch school there are, among others, some 40 Rubenses, 20 Van Dycks, over 20 Rembrandts, besides Ostades, Gerard Dows, Teniers, Wouvermanns, etc. Of the old German school Holbein's 'Madonna,' a sublime work, is particularly distinguished. Of the French school there are many Claude Lorraines, Poussins, Le Bruns and others. Of the Italian school the gallery is rich in pictures of Correggio, including his famous 'La Notte' or 'Holy Night'; of Raphael, the 'Madonna di Sisto,' the 'Madonna della Seggiola' and others. There are also works of Leonardo da Vinci, Giulio Romano, Andrea del Sarto, Battoni Titian —his famous 'Venus' and 'The Tribute Money,' Garofalo, Paolo Veronese, Guido Reni, Carracci, Carlo Dolce, and every distinguished Italian painter. Many modern painters are also represented, among them Hofmann and several specimens from the Düsseldorf school. Murillo and Velasquez are represented by one picture each. This collection is liberally open every day to all visitors. Besides this fine gallery of pictures the museum contains also a collection of engravings and drawings, in all amounting to upward of 350,000. There is here also a rich collection of casts exemplifying the progress of sculpture from the earliest times and including copies of all the most important antiques, made under the direction of Raphael Mengs, in Italy. The collection of antiques in the Japanese Palace contains some excellent statues, among which are distinguished three female figures from Herculaneum. The Johanneum Museum contains a historical museum and a large variety of specimens of Chinese, Japanese, East Indian, Sèvres, Meissen, etc., porcelain ware, arranged chronologically. Dresden being thus rich in treasures of art and favored by a beautiful natural situation is the summer resort of many foreigners.

Dresden is of Slavonic origin and first came under German and Christian influence after the subjugation of the Slavs, about the year 922. At the beginning of the 13th century it is mentioned in documents as a city and as a residence of the margraves of Meissen. Since 1485 it has been the residence of the rulers of Saxony. In the first half of the 18th century it was greatly embellished, but suffered much in the Seven Years' War. In 1760 for nine days it was bombarded by Frederick the Great. The Austrians occupied the city in 1809 without injuring it. The campaign of 1813 was most ruinous for the city

and its environs. From May till about the middle of September it was held by Napoleon, and severe fighting in and around the city took place almost every day. After some years of war and suffering on 7 June 1815 peace and industry returned to the "German Florence," as Herder calls Dresden. After that time dwelling-houses, gardens and parks took the place of the former fortifications. During the revolutionary movement of 1849 it suffered severely. In 1866 it was occupied by the Prussians, but was evacuated in the following spring. It has been greatly beautified and extended in recent times (especially under the auspices of King John), and its population is rapidly increasing. Pop. 548,308.

DRESDEN, Battle of, a battle fought in 1813, when an allied army of 150,000 Russians, Austrians and Prussians, commanded by Prince Schwarzenberg, sought to regain possession of Dresden, which was occupied by 20,000 French troops under Saint-Cyr. The Allies appeared before Dresden on 25 August, but Schwarzenberg did not attack until the following morning, when each division drove back the French and gained advantageous positions in the city, so that it appeared as if Saint-Cyr would be forced to capitulate. In expectation of reinforcements and satisfied with the morning's achievements, Schwarzenberg at noon called a halt. The delays proved fatal. Napoleon, who had gone to the support of Ney, against Blücher in Silesia, on learning of the Allies' march on Dresden, had hastened back, and during Schwarzenberg's unfortunate halt, French reinforcements were flocking across the Elbe, so that at four o'clock in the afternoon, when the Allies resumed the attack, there were 100,000 troops, who easily opposed all their efforts and drove them from their hard-won positions. Darkness stopped the conflict, which Napoleon resumed early the next morning, the fight continuing throughout the day until a strategic cavalry charge under Murat in the rear of the Austrians broke their line of resistance and practically ended the battle, the Allies beginning their retreat into Bohemia at four in the afternoon. The French took over 20,000 prisoners, while the killed and wounded on either side were estimated at between 7,000 and 8,000.

DRESDEN PORCELAIN, called by connoisseurs *Meissen ware,* frequently termed *Saxe* or *vieux Saxe.* It was the first hard porcelain made in Europe. Johann Friedrich Böttger, alchemist to Augustus II, king of Saxony, had exhausted his patron's patience by failing to carry out his promise to convert base metals into gold, after loss of much time and money. His life in danger, he was persuaded by von Tschirnhaus, a scholar and able chemist, to turn his efforts toward attempting the production of porcelain. Böttger's attempts were first rewarded by the discovery, in 1707, of a process of making a fine red stoneware (termed then *Eisenporzellan*) that was so hard it took on a polish from friction. Services of this ware pleased the king and court, and it became popular later under the name *Böttger ware.* By 1710 this dark red ware was turned out in table services, vases, candelabra, pipe-bowls, small figures, etc. Some pieces received enamel-color, gold and silver decoration. This Böttger ware was soon being made in several localities (Plaue, Bayreuth, etc.).

In 1709 or 1710 Böttger succeeded in getting kaolin, the porcelain clay of the Chinese, from Aue and Colditz. True porcelain pieces were now produced. Böttger's vicious and drunken habits brought about his death in 1719.

Meissen's output from 1707 to 1719 is known by experts as First Period ware. The porcelain was quite plain at first or had simple applied reliefs, all without color decoration, the chemistry and practice of porcelain (*grand feu*) colors being then unknown. Goldsmith Funcke, of Dresden, had decorated some pieces of the red stoneware in gilt and some gold ornamentation was done on the early porcelain, which, otherwise, attempted to reproduce the Chinese white porcelain (*blanc de chine*).

Characteristics.— Two different clays were used in making this early porcelain ware. One was called *blaue Masse* (a blue clay) and the other was a white clay. Hence two kinds of body are found, the blue clay making a white paste and the white clay producing a body of yellow tinge and having little holes and unable to take underglaze blue decoration. Later this trouble was overcome. Some pieces copy the forms of silverware of the period; the court goldsmith, Irminger, designed them. The Chinese styles found on other pieces were taken from examples in the fine collection of Oriental porcelains belonging to Augustus. A mark, the "caduceus wand," no doubt referred to Böttger's alchemistic transformation, but was used later than this period.

Second Period (1719–35).— Called also "painting period." Dr. Nehmitz, Böttger's furnace and glaze manager, with von Holzbrink, J. G. Mehlhorn and Steinbrück straightened out the confused condition Böttger left behind. The king died and, under Augustus III, his successor, Graf Brühl headed a commission to regulate the business and factory. Decoration, paste and glazing were much improved, and, with more scientific firing, much of the great losses from crazing were obviated. Cobalt being discovered in the Saxon mines, Köhler (who later became manager) commenced, unsuccessfully, blue underglaze decoration; the color "ran" into the glaze and was defective. Johann Gregor Herold, an expert on colors and painting at the Vienna factory, fled to Meissen (about 1719). His all-round knowledge of the technique of porcelain making soon procured him the directorship of the entire factory. On his retirement in 1765 he had given the factory a high reputation for finely painted wares, besides having greatly advanced the potting technique.

Characteristics.— Numerous qualities of body appear in specimens of this period. It was a period of experiments in clays. Styles were continued from last period, but breakfast services were a specialty. Applied molded decoration was favored. Vases for chimney ornaments were in sets of five and seven. With J. J. Kändler as modeler (from 1731) beautiful sculpture work came into competition with the painted decoration. The clever modeler Kirchner had long aided with his vases and animals, but now resigned (1733), fearing the prestige Kändler was gaining. Herold trained a staff of color decorators and instituted "team work" like the Chinese, giving over gilding to one man, underglaze blue painting to another,

flowers to the next, figures to another, and so on. Decoration now extended to overglaze colors as well as underglaze blue. A yellow ground color was in use by 1725. Starting with imitation of Japanese and Chinese examples, and white reserve panels, etc., Parisian artists were next copied. Elaborate gilt borders and backgrounds of violet, heightened by gold network, etc., came into vogue; scenes à la Watteau, and the Dutch sea coast accompanied by rococo scrollwork. A. Bottengruber and Preussler were prominent artists of this time.

Third Period (1735–40).— This is often termed the "plastic period." The sculptor, Johann Joachim Kändler, brought great renown with his masterly human figures and groups ("crinoline groups") and other relief work. Herold was forced to let flat color decoration take second place.

Characteristics.— Elaborate moulded Baroque ornament produced a plastic body, human heads, swans, cupids, dolphins, acted as handles. While continuing, to some extent, the Oriental forms and painted motifs, European decoration was preferred. Cobalt blue decoration was now a success. Figures innumerable were made, including classical gods and goddesses, shepherds and shepherdesses, street hawkers, the Seasons and the noted "monkey orchestra."

Fourth Period (1740–56).— Called also "rococo period." The Louis Quinze rococo style began to displace the former baroque early in this period. Groups found their fullest play now. The Seasons were followed by the Senses, Quarters of the Globe, Arts and Sciences. Watteau groups, cupids (*amorini*) became the rage, "Dresden" flower decoration for candelabra.

Characteristics.— The rococo "scroll" appears and the former ground color gives place to "scale" and other motifs in purple, blue, green, yellow. Paris prints are found in the decoration; camaieu is in vogue. Underglaze blue was continued and armorial bearing decoration made to order was popular with the wealthy.

Fifth Period (1756–63).— Prussia, under Frederick the Great, ravaged the country now and forced a tribute of great lots of porcelain, besides deporting many of Meissen's best workers. Nothing new in style or decoration appears in this time except the commencement of Greco-Roman antique tendencies.

Sixth Period (1763–74).— The factory now had to be revitalized and the rivalry of porcelain factories at Sèvres, Vienna, Berlin, etc., contended with. Michael Victor Acier, the Paris sculptor, was engaged in 1764 to give new life to the modeled forms, as Kändler's work had lost in popularity. He created the figures of French street criers, etc., and assisted Meissen's prosperity. Lovely, delicate lace effects were produced in this period. Search was made for improved colors in other factories, Sèvres *bleu de roi* especially. Meissen's fame was waning.

Seventh Period (1774–1814).— Often termed the "Marcolini" period. Count Camillo Marcolini was made chief director and started retrenchment to make up for the immense losses caused through severe competition. He forced sales of surplus stock by lowering prices; he reduced salaries. Financial embarrassment, in 1790, forced a subsidy from the state. All without success. His resignation, in face of impossible retrievement, when offered was refused and the factory had to close in 1810. This caused so much labor disturbance that the works were opened again and sales prices again reduced, while much was sold without decoration. Such sales account for much of the spurious "Dresden" ware which is of Dresden body but fake decoration. Marcolini retired in 1814. Napoleon's activities were ruining all European commerce; Wedgwood's ware, from Staffordshire, had become the rage all over the civilized world (see WEDGEWOOD WARE). By 1833, with Kühn as director, the Königliche Sächsische Porzellan Manufaktur gradually began to rally in its finances, now using old forms and decoration which had made Meissen famous. Later followed Barthel (1871), Brunnemann (1895). Up to the time just before the World War (1914) "Dresden" art ware was made on quite a large scale and found a good all-world demand.

Characteristics.— Wentzel succeeded in producing the noted *bleu de roi* ground color so long sought after. Acier's *rococo* style had to change to the more modern Louis Seize style, with its torch and crescent, festoon, creased-ribbon bow motifs, oval medallions encircled with laurels and containing monograms or portraits. Classic forms were revived. Imitations were made of Wedgwood's white reliefs on blue "jasper" backgrounds.

Marks.— The Dresden "cross swords" was used from 1723 to the present time. It was taken from the state coat-of-arms. Chinese marks were used at different times. A.R., for Augustus Rex, was used from 1725 to 1740. K.P.M., for Königliche Porzellan Manufaktur, occurs from 1723 to 1730. Other marks, K.H.C., K.H.K., K.H.K.W., K.C.P.C., etc., were initials of different branches of the royal household or estates of the king. The "cross swords" *scratched* through is the erased mark on pieces that were sold in the white for others to decorate.

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CLEMENT W. COUMBE.

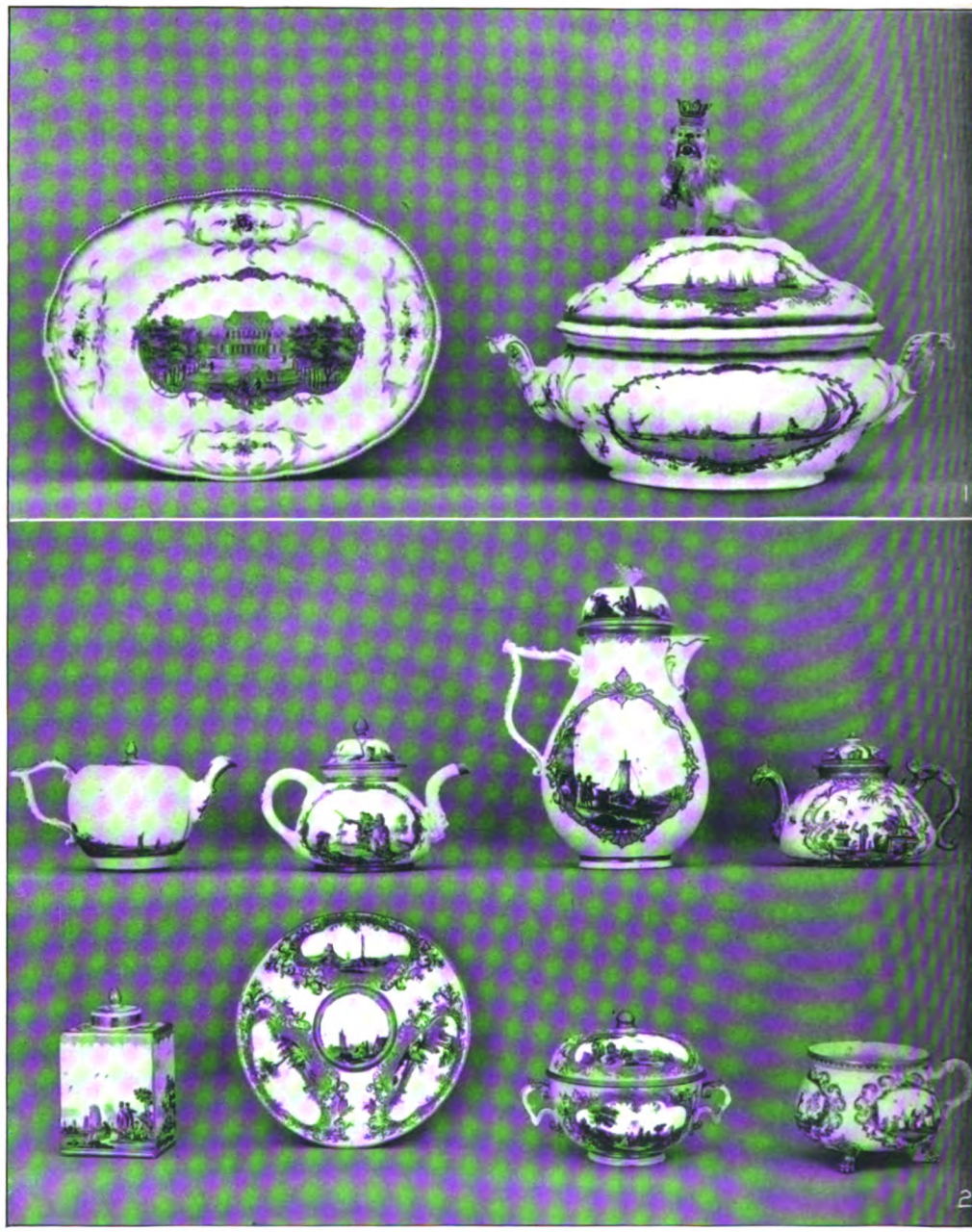
DRESDNER BANK, The. The Dresdner Bank was founded in Dresden in 1872 with a capital of 9,600,000 marks, and in 1881, by the establishment of a branch, transferred its centre of activity to Berlin. Its first success was in its deposit business, closely followed by its regular banking business, in which it is to-day one of Germany's leading institutions. It is particularly strong in southern Germany through the number of banking institutions absorbed or

1 Early Dresden Cup (about 1720)

2 Jar in Chinese Form. "Escotic" Birds in Medallion (1725)

3 Polychrome Plate. "Chinese Taste" (1720–1730)

DRESDEN (MEISSEN) PORCELAIN



1 Tureen and Platter. 18th Century

2 Table Ware with Scenic Decoration (1725-1731)

established there. In many respects it has pursued a policy parallel to that of the Deutsche Bank, both in domestic finance and overseas business, the latter being initiated in 1892 by the absorption of a branch in Hamburg, followed in 1895 by a branch in Bremen and in 1901 in London. In all, the Dresdner Bank had (beginning of 1909) 27 branches, all, with the exception of the one in London, being located in Germany. In addition it has one Commandite and 57 deposit offices, 23 being in Berlin. Its foreign business is carried on through subsidiaries in China, Japan, Italy, Switzerland, Turkey, Greece, Egypt, Morocco, Argentina, Mexico and Canada, and in 1905 a close alliance was formed with the banking house of J. P. Morgan & Co., New York, for joint action in international finance and issue operations, particularly the absorption of American securities by German investors. Operations in the Orient and South America have been carried on jointly in co-operation with the A. Schaaffhausen'scher Bankverein. Between 1872 and 1909–10, important German banks and banking firms having numerous branches throughout Germany were absorbed by the Dresdner Bank. Important among these was the Deutsche Genossenschaftbank (Bank for Co-operative Credit Societies), Sörgel, Parrisius & Co., of Berlin and Frankfort-on-the-Main, closely identified with German industrial and agricultural co-operative societies. A special department of the Dresdner Bank is also concerned with the fostering of these interests. In addition, in 1904, jointly with the A. Schaaffhausen'scher Bankverein, the banking house of Von Erlanger & Söhne of Frankfort-on-the-Main was absorbed, this latter having 8 branches and 97 agencies, besides community-of-interest connections with 2 banks having 52 agencies. In addition, through board supervision or stock control, 12 other important banks with numerous branches and agencies are included within the Dresdner Bank group. The relations of the Dresdner Bank to the industrial life of Germany are indicated by the fact that at the beginning of 1909 representation was had on the boards of 87 other important industrial and financial organizations. In 1908 the capital was 180,000,000 marks (increased in 1910 to 200,000,000 marks), surplus 51,500,000 marks and dividend 7½ per cent. The total capital power of the Dresdner Bank group in the same year amounted to 283,942,419 marks, of which 227,680,000 constituted the capital and 56,262,419 marks the surplus. Consult Riesser, Dr. J., 'Die Deutsche Grossbanken und ihre Konzentration' (1909); 'Germany's Economic Forces' (1913); 'Report on Cooperation in American Export Trade' (Washington 1916).

DRESS, the clothing or apparel of the human body. Under this title will be considered the principles underlying the wearing of clothes rather than the minute details of their shape and color, which will be found treated under COSTUME. The evolution of dress has always been associated with the growth and decline of nations and therefore sheds much light on racial characteristics. In the earliest stage of human history dress must of course have been strictly utilitarian, consisting only of the covering necessary to protect the body against the extreme conditions of climate and temperature. With many uncivilized tribes this conception of the function of clothes still survives.

With the dawn of civilization another utilitarian function is assumed by clothes. Clothing becomes a means of indicating distinctions of rank and office in the community. The minimum of clothing is found among slaves and the lowest classes in general, while garments even more massive and extensive than either climatic conditions or considerations of modesty prescribed come to be worn by those in the higher ranks. Next, a purely decorative motive, which undoubtedly has its source in personal vanity, came to supplement the two more utilitarian ones just mentioned. With some uncivilized or semi-civilized peoples this is by far the strongest and frequently the only motive for the wearing of such scant vestments as neither cover nor protect the body. That personal vanity underlies the use of clothes quite as much as considerations of modesty and temperature even among civilized peoples is a view held by many authoritative scientists.

The Assyrians covered themselves entirely with heavy draperies, stiff with embroidery. The Egyptians, of whose dress we have the earliest records, clothed themselves in thin materials which revealed the lines of the body and frequently left even the limbs exposed. Their dress was rich in texture and splendid in coloring, the designs of their textile fabrics being of high artistic excellence and beauty. Class distinctions were very strongly emphasized in the dress of the Egytians. A peculiar feature of their priestly garb was the leopard-skin worn on solemn sacrificial occasions. The Egyptian women of rank wore beautiful embroidered skirts secured at the waist by a colored sash, or suspended by straps from the shoulders, and over this a long, loose robe. The laboring class used woolen fabrics, but their costumes, especially when at work, consisted as a rule simply of a loin-cloth and girdle. Among the Chinese the predominating idea of dress has always been splendor of material and decoration. The intense conservatism of this race is nowhere better shown than in the almost complete sameness of dress from earliest times to the present day. That, as a general rule, progress in civilization — and especially a sudden leap in this direction — makes for radical dress reform, is well illustrated in the case of the modern Japanese. For a long time the figure was merely draped in loose lengths of material, with no attempt at conforming to the lines of the body or limbs — though sleeves and trousers are occasionally observed, as in the Persian sculptures at Persepolis. The primitive sandal was evidently thought to afford all necessary protection to the foot, until the time of Assur-bani-pal, or Sardanapalus, when soldiers and hunters appear to have worn a sort of net to protect their legs and boots or gaiters somewhat like the Greek and Roman *cothurnus,* laced in front. Save as official costumery, hats and caps were little worn in early times. Even in the time of Julius Cæsar they were little used except by travelers, most people preferring a fold of the toga or mantle for a head covering. Among the Greeks and Romans the division of classes and professions by dress were very striking. By the Greeks the artistic effect was carried to a height

hitherto unknown, their garments being the perfection of grace and dignified elegance. At no other time has a nation's dress offered such great advantages to the artist. The Greek *chiton* and *himation* of about 450–350 B.C. were the highest type of loose clothing, while the highest type of the more tightly fitting costume was found in England and France in 1350. The costumes of western Europe during the last quarter of the 14th and the first of the 15th century were characterized by a beautiful reasonableness and adaptation at once to use and artistic effect. But there have been other periods in which the exaggeration of good sartorial points led to utter absurdities and demoralization. After the Norman Conquest, which introduced into England, among other unsalutary features, numerous ugly changes in dress, eccentricities in headgear were especially prevalent. In the 17th century shoes grew so small and pointed that they were an encumbrance to the wearer and had to be hooked up by their projecting tips to make walking possible. Small waists were considered quite as essential for men as for women. Even as late as the reign of George III, English tailors advertised corsets for gentlemen. The modern tendency in dress, as in many other things, is decidedly democratic — a tendency toward the complete elimination of differences in dress as marks of social or other distinction. The dress reform movement inaugurated in the 19th century and the greater attention paid to hygienic considerations have resulted in making women more solicitous about the health and comfort of the body than they have been for many centuries previous. Extravagance in dress has always been a mark for social and religious reformers. Both in France and in England, especially during the Puritan period in the latter country, preachers thundered from many a pulpit against the senseless fashions of their times. Sumptuary legislation has attempted time and time again to regulate it, but usually without success. In England, particularly under the Tudors, considerable drastic legislation was enacted on the subject of dress. Beginning as early as 1463 and taking on a most mandatory form in 1510, when "An Act against wearing of costly Apparel" was passed, such legislation was re-enacted, or re-enforced, again and again, taking a different — usually a more stringent — form from time to time. But, custom proving stronger than legislation, the people constantly overstepped the bounds of dress laws, with the result that all such legislation was finally repealed in England in 1604, a century before such action was taken in other countries. There are two satirical literary treatments of this aspect of dress which are especially famous, that of Swift in the 'Tale of a Tub,' and that of Carlyle in 'Sartor Resartus.'

Bibliography.— Most of the literature on the subject is in the form of magazine articles. The following works treat of dress, specifically or generally: Earle, 'Two Centuries of Costume in America' (2 vols., New York 1904); Evans, 'Chapters on Greek Dress' (London 1893); Farnsworth, 'The Art and Ethics of Dress' (1915); Fox, 'Fashion: the power that influences the World. The Philosophy of Ancient and Modern Dress and Fashion' (New York 1872); Hill, 'History of English Dress' (London 1900); Lacroix, 'Manners, Customs and Dress of the Middle Ages and the Renaissance' (London 1877); McClellan, 'Historic Dress in America, 1607–1800' (Philadelphia 1904); Walker, 'Dress as it has been, is, and will be' (New York 1885); Winterburn, 'Principles of Correct Dress' (1914). See COSTUME; DRESS REFORM; FASHION.

DRESS REFORM, a movement of the 19th century, having for its aim the modification of the dress of women along hygienic lines chiefly, but also with regard to comfort and convenience. Many articles of feminine apparel had long been operating against the health of the wearers and the injurious effects had been recognized and more or less frankly discussed in private circles before leaders were found with sufficient earnestness and courage to make organized efforts for reform. So far as the United States is concerned dress reform may be said to date from 1851, when Amelia Bloomer published some articles in favor of freer dress for women in her paper called *The Lily*. A few years before the Civil War (in 1857) a National Dress Association was started, but made little headway. It was not until a similar society was organized in Boston in 1874 that attempts of this nature began to bear any fruit. Several causes seem to have contributed to making the time more propitious for an active propaganda against tight-lacing, high-heeled and cramping foot-wear, trailing garments, etc. The greater attention paid to physiology in schools dispelled to some extent the ignorance which had been a partial excuse for unhygienic methods of dress. The increasing number of women receiving a college education ensured for the new ideas an audience with minds too liberal and judgments too sound to be rigidly fettered by conventionality and fashion. A third factor not to be disregarded was the firm attitude of physicians. Prevention of disease and the development of normal conditions was becoming the watchword where formerly curative measures had been emphasized. The co-operation of the medical fraternity by lectures, periodical literature and personal influence should receive due credit for the progress of dress reform. Such co-operation was a marked feature of the movement inaugurated in Boston. As the century drew to a close conditions became still more favorable. The prominence given to bacteriology associated in innumerable minds the trailing skirt with germ-transportation. The investigation, too, into the relative values of the different fabrics — cotton, linen, silk and wool — as material for underwear (a discussion in which Germany took a notable part) was very timely. It called attention to the lamentable lack of judgment exhibited by many persons, especially women, in protecting themselves by suitable under garments against the changes of the season, and especially the sudden variations of the American climate. The adoption of outer garments suitable for wet weather was undoubtedly hastened by the vogue of the bicycle skirt, which accustomed the eye to a style of garment once attracting unfavorable comment or at least unwelcome observation. Rainy-day clubs, formed in many cities, have done their share toward the introduction of the short skirt. The fact that a great number of women are now daily going to business has also

greatly promoted the movement of rational clothes for women. To athletics, too, woman's dress reform is deeply indebted. The present popularity of out-of-door exercise and sport for women and the general interest taken in physical culture have inevitably tended to modify the form of women's garments.

The practice of lacing, with its vicious results of molding the femimine form into abnormal lines and crowding the vital organs into disease-promoting states, still persists among women who place less value on health and bodily comfort than on outward appearance and unnatural "grace." Yet on the whole, the movement toward rational raiment for women is making steady if seemingly slow progress on both sides of the Atlantic. Æsthetic considerations had little effect upon the earliest dress-reformers such as Mrs. Amelia Bloomer and a few women suffragists who first braved public opinion by a radical change of costume. The Turkish trousers and very short skirt adopted by Mrs. Bloomer did not invite imitation; but later phases of reform, both in England and in America, have aimed at grace and beauty as well as health and comfort in the style of garments advocated. In the United States Mrs. Annie Jenness-Miller has been a prominent exponent of the more artistic aspect of the subject. Very near the time of the establishment in this country of the second National Dress Association an attempt was made by the crown-princess of Saxony to awaken her fellow countrywomen to the importance of dress-reform, the hygienic side of the question being most prominent in that effort. Under the leadership of Lady Harberton, president of the Rational Dress Association, the dress reform movement assumed a somewhat different direction than that associated with Mrs. Jenness-Miller. To retain the natural beauty of the human form and succeed in its harmonious appareling were the aims of some of the dress reformers. There was, however, side by side with this movement one having a utilitarian trend. This was allied to the German movement in favor of more hygienic garments; the combination of lightness and warmth in the material used being a great desideratum. Organized effort along the line of dress reform in England has resulted in the formation of the Rational Dress Association just mentioned and the National Health Dress Association. There is also a society having for one of its aims a change in the customary mourning apparel. Outside of Germany and England little interest has as yet been taken in Europe in the subject of dress reform, although a certain Russian Minister of Education tried in vain to prohibit corsets. Consult Bloomer, 'The Life and Writings of Amelia Bloomer' (Boston 1895); Godwin, 'Dress and Its Relation to Health and Climate' (London 1884); Harbeis, 'The Art of Dress' (ib. 1881); Woolson, 'Dress Reform' (Boston 1874). See DRESS; COSTUME; FASHION.

DRESS SHIP, nautical term signifying the decoration or ornamentation of a ship with flags. It is done on national holidays or on some special occasion. There are many forms and degrees, according to the importance of the occasion or of the personage to be honored. Hoisting the national colors at the mastheads and at the peak is, perhaps, the simplest form of dressing a ship. Additional flags, usually those of the signal code, are hoisted to full-dress a ship. The ordinary method is to arrange the flags in a line from the water forward, up the forward stay between the mastheads to the peak and thence over the stern. At the stern and prow weighted lines are dropped to which the flags are attached. When doing honor to a foreign nation the latter's colors are run to the head of the main mast. When more than one country is represented by its colors all must be given posts of honor and none placed in a position of inferiority to another. In naval vessels the flags of the navy signal code and of the international signal code are used jointly. During the Hudson-Fulton celebration in New York in 1909 the American and visiting foreign naval vessels were dressed with electric lights, arranged to outline the hull and superstructure when illuminated.

DRESSER, Henry Eeles, English ornithologist: b. Thirsk, Yorkshire, 9 May 1838. He is best known by his 'History of the Birds of Europe' in eight volumes (1871–81).

DRESSER, Horatio Willis, American author: b. Yarmouth, Me., 15 Jan. 1866. He was educated in Denver, Colo., and at Boston; was appointed assistant in philosophy, Harvard University, 1902–11; professor of philosophy, Ursinus College, 1911–12. Since 1893 he has lectured and written extensively on practical philosophy and metaphysics, and he edited and published the *Journal of Practical Metaphysics* 1896–98; but it must be pointed out that these terms as used by him and his school of thought have meanings entirely different from those in which they have hitherto been used and are generally understood. He edited *The Higher Law* 1899–1902, and is the author of 'The Power of Silence' (1895); 'The Perfect Whole' (1896); 'In Search of a Soul' (1897); 'Voices of Hope' (1898); 'Methods and Problems of Spiritual Healing' (1899); 'Education and the Philosophical Ideal' (1900); 'Voices of Freedom' (1899); 'Living by the Spirit' (1900); 'The Christ Ideal' (1901); 'A Book of Secrets' (1902); 'Man and the Divine Order' (1903); 'Health and the Inner Life' (1906); 'The Greatest Truth' (1907); 'A Physician to the Soul' (1908); 'The Philosophy of the Spirit' (1908); 'A Message to the Well' (1910); 'Human Efficiency' (1912); 'The Religion of the Spirit in Modern Life' (1914).

DREUX, drė (ancient DUROSCASSÆ), France, one of the oldest towns on the Blaise, 20 miles north-northwest of Chartres. It has a number of churches and other buildings of the 11th, 12th and 13th centuries. It has foundries and manufactures cloth, leather and glass and trades in sheep and cattle. In Roman times it was called Durocassis or Drocæ and was also important under the Gauls. Here the Duc de Guise defeated the Huguenots and captured the Prince of Condé in 1562. The Germans took the town in 1870. Pop. 10,500.

DREVET, drė'vā', French family of engravers. (1) PIERRE: b. Saint Colombe, near Lyons, 1664; d. Paris 1739. He studied at Lyons, and at Paris with Audran and Rigaud. In 1696 he became court engraver and was elected to the Academy in 1707. He left more than 100 plates, of which the recognized master-

piece is 'Louis XIV' (1712). He was particularly successful in the engraving of portraits. (2) PIERRE IMBERT, his son: b. Paris 1697; d. there 1739. He studied with his father, but surpassed him in art. He, too, was most successful in portrait work, one of his best pieces being a portrait of Bossuet after Rigaud; he also copied the works of Coypel, Restout, Andray and other French painters of the time. He succeeded his father as court engraver and they executed many works together. (3) CLAUDE, the nephew of Pierre Imbert: b. Lyons 1710; d. Paris 1782. He was a pupil of his uncle and copied his style without equaling his art. Consult Firmin-Didot, 'Les Drevets' (Paris 1876).

DREW, Daniel, American capitalist: b. Carmel, N. Y., 29 July 1797; d. New York, 19 Sept. 1879. In early life he was a cattle drover and dealer and was subsequently prominent as a steamboat builder, but was most widely known from his connection with railroads and as a leading stock speculator in Wall Street. The failure of Kenyon, Cox & Co. caused the loss of his great fortune, which at one time amounted to about $15,000,000. He was the founder of the Drew Ladies' Seminary at Carmel and the Drew Theological Seminary (q.v.) at Madison, N. J. He also gave large sums of money to various Methodist colleges and schools. Consult White, Bouck, 'The Book of Daniel Drew' (New York 1910).

DREW, John, American actor: b. Philadelphia, 13 Nov. 1853. In 1873 he first appeared at his father's theatre in Philadelphia, then under his mother's management. For the next six years he played with the popular stars of that day, including Edwin Booth and Fanny Davenport. In 1879 he appeared as leading man in the all-star company of Augustine Daly, at Daly's Theatre, New York. His most noteworthy successes there were as Petruchio in 'The Taming of the Shrew,' and as Charles Surface in Sheridan's 'School for Scandal.' He appeared also in the classic revivals and in original productions of Mr. Daly. He visited Europe in 1892 with Daly's Company, playing classic rôles, and began his starring tours in the autumn of 1892, playing in 'The Masked Ball,' 'The Butterflies,' 'A Marriage of Convenience,' 'One Summer's Day,' 'The Liars,' 'Richard Carvel,' 'His House in Order,' 'Inconstant George' 'Much Ado about Nothing,' 'The Tyranny of Tears' and 'The Will.' John Drew is the best living interpreter of a certain type of character common in high society in America. In 1901 he appeared in a revival of 'The Second in Command.' Consult Strang, 'Famous Actors of the Day' (Boston 1900); Moses, 'Famous Actor-Families in America' (New York 1906); Winter, 'Wallet of Time' (2 vols., New York 1913).

DREW, John, American comedian: b. Dublin, Ireland, 3 Sept. 1825; d. Philadelphia, Pa., 21 May 1862. He made his first appearance at the Bowery Theatre, New York, in 1845, and later became manager, in connection with William Wheatley, of the Arch Street Theatre in Philadelphia. He acted in the principal cities of the United States, England and Australia.

DREW THEOLOGICAL SEMINARY, in Madison, N. J., an educational institution founded by the Methodist Episcopal Church for the education and training of its ministers. Daniel Drew donated the ground and buildings. Three years suffice to cover the prescribed courses, which in addition to special training in theology, etc., also cover a wide range of secular subjects in order to provide ministers of broad minds and of good general education. The degree of B.D. is conferred on students who already hold an academic degree, and the degree of doctor in theology is conferred on students who take the advanced courses prescribed for this degree. Tuition is free, and arrangements have been made whereby the cost of student life is most moderate. There are eight buildings altogether, which with the grounds are valued at about $725,000. The productive endowment funds total over $1,000,000. The seminary is provided with an excellent library of 126,000 volumes and 140,000 pamphlets. The enrolment of students in 1916 was 171, and there were 16 instructors.

DREWRY'S BLUFF, Battle of. When General Grant began his campaign for Richmond in May 1864, General Butler, commanding the Army of the James, was directed to be well up James River toward Richmond by daylight of the 5th and to push ahead with all energy. By the 6th Butler had reached and entrenched at Bermuda Hundred Neck. Kautz's cavalry division, moving from Suffolk, destroyed several bridges on the Norfolk and Petersburg and Weldon railroads and joined Butler on the 10th. On the 9th Butler advanced with the greater part of his force to strike the railroad connecting Richmond and Petersburg, but his advance was barred by Swift Creek, which was found impassable and its bridges heavily guarded, upon which he ordered his troops to withdraw to their entrenchments; but the withdrawal was not effected without an attack by the Confederates on a detachment of the 10th Corps, in which the loss was severe on both sides. Butler's advance was barred by strong works on Drewry's Bluff on the right bank of the river, eight miles below Richmond. The works could not be reached by the navy, and on the land side the Bluff was defended by 22,000 infantry and over 2,000 cavalry, field artillery and heavy guns. On the 12th General Butler moved along the turnpike and after some fighting the Confederates fell back toward Drewry's Bluff. On the 15th there was heavy all-day skirmishing and some artillery firing, and General Beauregard issued orders for an attack next morning to cut Butler off from Bermuda Hundred and capture or destroy his army. The attack was made very early in the morning under cover of a dense fog; the right of Butler's line was turned and a large number of prisoners taken, compelling it to fall back a short distance. On the left Butler's line held its ground and made some progress, but toward evening Butler ordered his troops to fall back and at night they were in the entrenchments at Bermuda Hundred. Beauregard followed and entrenched in front of Butler's lines. As General Smith says, "Both corps re-entered the historic bottle, which was at once carefully corked by a Confederate earthwork." On the 20th Beauregard assaulted and carried some of Butler's advanced lines and a sharp fight ensued to regain them, which was only partially successful, a portion of them being retaken by Howell's brigade of the 10th Corps,

which lost 702 men; the Confederate loss was nearly 800. On the 29th General Smith with three divisions of the 10th and 18th corps, 16,000 men, and 16 guns, left the Army of the James and joined the Army of the Potomac in time to take part in the battle of Cold Harbor. The Union forces engaged in the battle of Drewry's Bluff, 16 May, numbered about 16,000, the Confederates about 18,000. The Union loss, 14–16 May, was 390 killed, 2,380 wounded, 1,390 missing. The Confederate loss, 16 May, was about 460 killed, 2,060 wounded, 212 missing. From 5–31 May, including all of Butler's engagements and Kautz's cavalry operations, the Union loss was 609 killed, 3,769 wounded, 1,580 missing; the Confederate loss for the same period cannot be definitely ascertained, but it was less than that of the Union forces. See 'Official Records' (Vol. XXXVI); 'Butler's Book'; Grant, 'Personal Memoirs'; Humphreys, 'The Virginia Campaign of 1864–65'; Roman, 'Military Operations of General Beauregard' (Vol. II); and 'Battles and Leaders of the Civil War' (Vol. IV).

E. A. CARMAN.

DREWS, Arthur, German philosopher: b. Uetersen, Holstein, 1865. He received his education at the universities of Munich, Berlin, Heidelberg and Halle. In 1898 he was appointed privatdocent of philosophy at Karlsruhe and 10 years later was made professor extraordinary. He is the editor of Hegel's 'Religionsphilosophie' (1905) and is the author of works of criticism on Kant, Nietzsche and others in 'Kants Naturphilosophie als Grundlage seines Systems' (1894); 'E. von Hartmanns philosophisches System im Grundriss' (2d ed., 1905); 'Nietzsches Philosophie' (1904); 'Lebenswerk Eduard von Hartmanns' (1907); 'Plotin und der Untergang der antiken Weltanschatsung' (1907). Other important works from his pen are 'Die Lehre von Raum und Zeiten nachkantischer Philosophie' (1889); 'Das Ich als Grundproblem der Metaphysik' (1897); 'Die Religion als Selbstbewusstsein Gottes' (1906); 'Der Monismus' (1908); 'Geschichte des Monismus im Altertum' (1913). Drews has become well known in America through his two works attacking the historicity of the narrative of the New Testament. These are 'Die Christusmythe' (1910; English translation by Burns 1911; part II, by McCabe 1912), and 'Die Petruslegende' (1910).

DREXEL, Anthony Joseph, American banker: b. Philadelphia, Pa., 1826; d. Carlsbad, Germany, 30 June 1893. He became the head of the well-known firm of Drexel & Company, Philadelphia, having been identified with it from the age of 13. He was zealous in promoting science and art, especially music, and contributed largely to philanthropic and educational interests. The Drexel Institute of Art, Science and Industry, Philadelphia (q.v.) was established by him. He became head of Drexel, Morgan & Co. of New York, and Drexel, Harjes & Co. of Paris. With G. W. Childs, he became owner of the Philadelphia *Public Ledger* (1864).

DREXEL INSTITUTE OF ART, SCIENCE AND INDUSTRY was founded at Philadelphia in 1891, by Anthony J. Drexel (q.v.). This school was established for the purpose of giving young men and women opportunity to receive training in the arts and sciences as applied to the industries. The requirements for admission depend upon the course which the applicant wishes to pursue; no degrees are given. In 1914 the trustees had applied for the right to grant degrees. The buildings and equipment given by Mr. Drexel cost over $4,000,000; and the amount of endowment, given also by Mr. Drexel, is $2,000,000. The courses offered are: Fine and applied arts; elective engineering; commerce and finance; mechanical drawing and machine construction; domestic science; mathematics; physics; chemistry; and English. Day and evening classes are provided for all departments. The length of time required to complete the work depends upon the course. The free public lectures provided by the institute are valuable educational factors.

The department of commerce and finance consists of three special departments: First, the course in commerce and finance; second, the office course; third, the evening course. These courses are founded on a broad and liberal basis, resembling generally the commercial schools of Europe, and they are intended to place commercial education in its proper relation to other departments of educational work. The object of the course is to train the young to do business rather than simply to record business. It provides a liberal and practical course of study for a two years' training in the knowledge of the world's industries and markets, the laws of trade and finance and the mechanism and customs of business. The first special department is intended to give a thorough fundamental training for the activities of business which include: (1) The production, sale and transportation of articles of commerce; (2) the management of stock companies and corporations; (3) the buying and selling of securities; (4) the importing and exporting of merchandise; (5) the borrowing and lending of money and credit; (6) the advertising of commercial concerns; (7) the keeping of business records. In addition three distinct office courses are offered, practical in character and designed to prepare the student for entering immediately upon the respective lines of employment to which the training leads. In 1895 a beginning was made toward the formation of a permanent commercial museum. The collection now represents quite fully the following industrial products: Flour, wool, petroleum, tea, coffee, sugar, cotton, copper, iron and steel, glass, tobacco, leather, paper, wood, carpets, linen, spices, aluminum, building stone, brick and terra-cotta. The art museum contains collections representing the industrial arts of Egypt, India, China, Japan and Europe. The library contains over 40,000 volumes and is supplied with books, periodicals and pamphlets bearing upon the work and every facility and assistance is afforded for the study of financial, economic and commercial questions. In 1915 the number of students in attendance was 2,900 in all departments. Applicants for admission to any course must pass satisfactory examinations in English, geography, arithmetic and United States history. For admission to the course in commerce and finance or to any of the

office courses the candidate must be at least 16 years of age. The diploma of a high school of approved standing is accepted in place of an examination.

DREYER, John Louis Emil, Irish astronomer: b. Copenhagen 1852. He received his education at the University of Copenhagen, and in 1874–78 was assistant astronomer at the Earl of Ross's observatory; in the following four years he served as assistant at the Observatory of Trinity College, Dublin, and in 1882 was made director of the Armagh Observatory. He has published 'The Second Armagh Catalogue of 3300 Stars' (1886); 'New General Catalogue of Nebulæ and Clusters of Stars' (1888; supplements, 1895, 1908); 'Tycho Brahe' (1890); 'History of the Planetary Systems from Thales to Keppler' (1906); and an edition of Herschel's 'Scientific Papers' (1912) for the Royal Astronomical Society.

DREYFUS, drā-füs, **Abraham,** French playwright: b. Paris, 20 June 1847. He had a fine vein of kindly humor and it pervades both his contributions to the public journals and his theatrical compositions, which are mostly in one act. Among them are 'A Gentleman in Black'; 'The Victim'; 'The Klepht'; 'A Break.' His four-act play, 'The Saint Catharine Institution,' a comedy of manners, was brought out at the Odéon (1881); 'A Rupture' (1885), etc.

DREYFUS, Alfred, French military officer: b. Mülhausen, Alsace, 1859. He was a member of a wealthy Jewish family, became a captain in the 21st regiment of artillery and three years later was appointed to the general staff. On 14 Oct. 1894 he was arrested on a charge of communicating certain important military documents to a foreign government, and at a secret court-martial on 19 December and succeeding days was found guilty and condemned to public degradation and lifelong imprisonment. He was degraded on 5 Jan. 1895, and in accordance with the act passed by the Chambers was sent to the Ile du Diable (Devil's Island) near Cayenne, to undergo the other part of the sentence. On 1 June of the same year Colonel Picquart became head of the intelligence department of the army, and in the course of his official duties discovered various circumstances which threw doubt on the correctness of the court-martial's decision and pointed to another officer of the name of Esterhazy as the real traitor. In particular he obtained a copy of a telegram-card, subsequently known as the *petit-bleu,* alleged to have been addressed to Esterhazy by a German officer, Colonel von Schwarzkoppen. On 7 Sept. 1896, he wrote to General Gonse urging a reinvestigation of the case, and seven days later a newspaper divulged the fact that certain documents had been communicated to the court-martial unknown to the prisoner's counsel. Not long afterward Dreyfus' accusers took a false step by the publication of the facsimile of the *bordoreau* (memorandum, detailed list of documents), alleged to have been written by Dreyfus; and on 16 November Colonel Picquart was superseded in his office by Colonel Henry. On 15 Nov. 1897 M. Mathieu Dreyfus, brother of the condemned man, charged Esterhazy with having written the *Bordereau,* but on 11 Jan. 1898 he was acquitted by court-martial which sat with closed doors. On the following day Colonel Picquart, who had been sent to Tunis on a dangerous expedition after his dismissal from office, had been afterward recalled to answer certain charges made by Esterhazy, was arrested and imprisoned. On 13 January M. Zola, the eminent novelist, published in the *Aurore* a letter headed *J'accuse* (I accuse), in which he made serious charges against the general staff and the government in regard to the Esterhazy court-martial. After a stormy debate in the chamber it was decided to prosecute him; but the government steadily refused to reopen the Dreyfus case, declaring their determination to stand by the *chose jugée.* Zola's trial began on 11 February, and on the 23d he was condemned to pay a heavy fine and to undergo a term of imprisonment. On 2 April the Court of Cassation quashed the sentence of Zola on technical ground, but a fresh prosecution was ordered a few days later. On 27 June M. Cavaignac became head of the war office, and 7 July he read to the chamber several documents which he regarded as proving the guilt of Dreyfus, but three days later Colonel Picquart wrote to the Premier denouncing these documents as forgeries. This interference led to his rearrest, and shortly after Zola was again condemned. On 31 August Colonel Henry was arrested and confessed to having forged the chief document relied on by Cavaignac, but soon after his arrest he committed suicide. The War Minister resigned 4 September and was succeeded by General Zurlinden. The latter resigned because of the government's determination to refer the question of revision to a commission, and on 18 September General Chanoine succeeded him. The commission decided against revision, and on 26 September the government resolved to ascertain the view of the Court of Cassation. On 25 October the Brisson ministry resigned and a few days later the court reported in favor of revision. On 31 October a new ministry under M. Dupuy came into office, and on 9 December the prosecution of Picquart was stopped by the Court of Cassation. The Dreyfus case marked the culmination of the anti-Semitic agitation in France, which began in *La Libre Parole* in 1882 and became specially menacing after the Panama Scandal in 1892. On 16 Feb. 1899 M. Félix Faure, the President of the republic, died suddenly and three days later was succeeded by M. Emile Loubet. On 3 June of the same year the Court of Cassation, having concluded its hearing of the evidence, ordered a fresh court-martial to be held at Rennes for the purpose of deciding whether Dreyfus communicated to a foreign government any of the documents mentioned in the *bordereau,* of which Esterhazy had previously confessed himself to be the author. Picquart was released on 9 June, and on the 12th of the same month the ministry was defeated. On 22 June M. Waldeck-Rousseau succeeded in forming a new ministry. The new court-martial opened 7 August, under the Presidency of Colonel Jouaust, and about this time the press published accounts of the inhuman treatment of Dreyfus in his prison. Dreyfus, who had been brought to Rennes for trial, was defended by MM. Demange and Labori. The chief witnesses in favor of the prisoner were Colonel Picquart and Captain Freystätter, a member of the first court-martial, and against him were Generals Mer-

cier, Gonse, Roget, de Boisdeffre and Billot. An attempt to assassinate M. Labori on his way to court 14 August was fortunately unsuccessful. On 9 September the judges, by five votes to two, declared the prisoner guilty, with extenuating circumstances. This verdict was flagrantly opposed to the published evidence, yet Dreyfus was sentenced to 10 years' imprisonment in a fortress, but a subsequent full pardon from President Loubet set him at liberty. On 12 July 1906 the Court of Cassation, after a rehearing of his case, began on 19 June, quashed the verdict of the Rennes court-martial. In its survey of the charges the court declared them without foundation; that the *bordereau* was the work of Esterhazy and that the information contained therein could not have emanated from an officer of the general staff, but must have been transmitted by a regimental officer such as Esterhazy. The court further held that three new facts had been established: (1) That the document from General Mercier's secret papers (letters supposed to have been written by Dreyfus, two in 1894 and one in 1896) presented at the Rennes court-martial, in which the initial "D" was substituted for "P," was a forgery; (2) That the document containing the plans for railway mobilization, supposed to have been given to the Germans by Dreyfus, never reached the War Department authorities and therefore Dreyfus could not have obtained possession of them; (3) That the Rennes court-martial failed to hear testimony which would have established the innocence of Dreyfus. He was therefore restored to the army with the rank of major on 13 July and Picquart was made a brigadier and subsequently Minister of War. In 1908 he was shot at and wounded by a reactionary journalist.

Bibliography.— Consult Dreyfus, 'Five Years of My Life' (1901); Barlow, 'History of the Dreyfus Case' (1898); Conybeare, 'The Dreyfus Case' (1898); Eugon, 'The Dreyfus Case' (1898); Steevens, 'The Tragedy of Dreyfus' (1899); Marin, 'Comptes-rendus officiels' (1897); Vanex, 'Dossier de l'affaire Dreyfus' (1898); Brez, 'Le solécisme du bordereau et des lettres de Dreyfus' (1898); Esterhazy, 'Les dessous de l'affaire Dreyfus' (1898).

DREYSCHOCK, drī'shŏk, **Alexander,** Bohemian pianist: b. Zach, Bohemia, 1818; d. Venice, 1869. He studied under Tomaschek at Prague and developed a truly marvelous technique. He began his concert tours in 1828 and continued them until 1848. In 1862 he received the appointment of professor at the Saint Petersburg Conservatory of Music, remaining there until 1868, when his failing health obliged him to travel to Italy. He left no important compositions.

DRIESCH, drēsh, **Hans,** German biologist: b. Kreuznach, Rhenish Prussia, 1867. He was educated at the universities of Freiburg, Munich and Jena. In 1889 and in 1893 he traveled in Ceylon, India, Java and Burma, and from 1891 to 1900 was employed at the Stazione Zoölogica of Naples. In the latter year he removed to Heidelberg and in 1909 became privat docent and 1911 professor extraordinary of philosophy at the university there. He is one of the founders of "vitalistic" biology, and has made special studies and experiments in the morphology of animals and made also special investigations in logic and natural philosophy. His published works include 'Die mathematisch-mechanische Betrachtung morpholigischer Probleme der Biologie' (1891); 'Die Biologie als selbständige Grundwissenschaft' (1893; 2d ed., 1911); 'Analytische Theorie der organischen Entwickelung' (1894); 'Die Localization morphogenetischer Vörgange' (1899); 'Die organischen Regulationen' (1901); 'Die "Seele" als elementarer Naturfactor' (1903); 'Naturbegriffe und Natururteile' (1904); 'Vitalismus als Geschichte und als Lehre' (1905); 'The Science and Philosophy of the Organism' (1909); 'Ordnungslehre' (1912); 'Logik als Aufgabe' (1913); 'The Problem of Individuality' (1914).

DRIFT, or GLACIAL DRIFT, a general name given to the deposits made by the ice sheets of the glacial period, or by the water which came from them. By some geologists the term is restricted to the unsorted deposits left by the ice itself, the deposits worked over by water being called stratified or modified drift. In this restricted sense drift includes (1) lateral and terminal moraines, and (2) till boulder clay or "hardpan," the sheet of clay that frequently covers rock surfaces in the glaciated regions. Drift is sometimes more or less sandy and always contains angular boulders with polished and often striated surfaces, the boulders being scattered through the clay without order. Usually the boulders are derived from rocks nearby, but fragments of tough hard rocks were sometimes transported long distances before being ground up by the action of the ice. Thus boulders from the peridotite at Cumberland Hill, R. I., have been found in the till of Martha's Vineyard, Mass., over 30 miles distant. The exact method by which till was formed is in dispute among geologists, though it is generally regarded as the ground moraine of the ice sheet, in spite of the fact that present glaciers are not forming a similar deposit. The boulders in the till in New Zealand are sometimes as much as 20 feet in diameter and in some places the till is so full of boulders as to render the soil formed from it unfit for agriculture. In northwest Ohio the till in many places is over 100 feet deep, and as it includes the detritus from softer rocks such as limestones, in that region boulders are fewer than in New Zealand and the resulting soil is very fertile. Englacial drift is the rock detritus carried along in the body of a glacier. See GLACIER; GLACIAL PERIOD; SOIL.

DRIFT OF A PROJECTILE, the deviation of the projectile when fired in still air from the vertical plane. The rifling of the gun makes the bullet rotate about its axis. A body rotating about its axis exhibits what is known as *precession;* that is, if a force acts to turn its axis in a given direction, the axis will move in a direction perpendicular thereto. A bullet leaving a gun begins to fall at once, and at its front end, which receives most of the air pressure, is consequently raised. This turns it in the direction of the rifling. This drift is often complicated by deflections due to the jump of the gun. The resulting deflection for the Springfield is 0.26 inch to the left at 100 yards, 0 inches at 500 yards, 13 inches to the right at 1,000 yards, 126.5 inches to the right at 2,000 yards and 456 inches to the right at 2,850 yards. The drift is

automatically corrected for by the sight up to 600 yards, and partly corrected for thereafter.

DRIFT SAND is sand thrown up by the waves of the sea and blown when dry some distance inland until arrested by large stones, tree roots, or other obstacles, round which it gradually accumulates until the heaps or dunes attain considerable dimensions. Except in the case of violent storm winds the action is generally a gentle rippling motion, the sand being pushed up by the wind on the seaward side of the ripple and rolling down into the hollow on the other side, thus traveling steadily landward. When these mounds have reached a certain elevation they are urged farther inland. "The same wind," says Cuvier, "that drives the sand from the sea upon the mound, drives the sand from its summit to its land side." In some parts of the coasts of France, the Landes of Brittany, in particular, these inroads upon the land have been attended with destructive consequences. The quantity of sand annually deposited along that coast is estimated at 3,000,000 cubic feet, and its annual progress inland some 72 feet. Such has been its destructive effects upon a village of Brittany that nothing is visible of it except a portion of the church steeple. In one or two such instances the sand dunes have moved away, exposing again the buried villages. For the purpose of arresting the inland progress of drift sand various measures have been adopted, the most successful being the planting of sand-loving plants with long creeping roots, such as *Carex arenaria*, which help to fix the sand and break the influence of the wind. In France the drift sands of the Biscay gales when unhindered advance upon the land at the rate of 16 to 17 feet per year. They have been checked in their encroachments by the planting of fir-trees in solid belts along the shores. Consult Cornish, V., 'Waves of Sand and Snow' (London 1914).

DRIFTLESS AREA, an area without glacial drift, (q.v.) specifically applied to an area of several hundred square miles in extent in Wisconsin and adjacent portions of Minnesota, Iowa and Illinois. Although this region is surrounded on all sides by evidences of glaciation, it has never itself undergone glacial action of any kind, and its topography is in marked contrast with that of surrounding areas. Just why this region should have escaped the glacial action that went on all around it, is by no means clear. Consult Sixth Annual Report, U. S. Geol. Survey, 1885, pp. 199–322.

DRILL, an ape of the Gold Coast of West Africa, the *Cynocephalus leucophæus*, closely allied to the mandrill (q.v.), whence its abbreviated name. It is, however, smaller than the mandrill, has a black face and a short, erect tail, not two inches long. It is distinguished by its white beard and profuse white whiskers and has a much less pronounced grooving of the face.

DRILL, OYSTER DRILL, BORER, or SNAILBORE, a small muricine gastropod mollusk, the American *Urosalpinx cinerea*, so named on account of its destructive propensities in boring through the shells of young oysters and feeding on them. The drill occupies a spiral, tawny brown shell, about an inch long and is found along the Atlantic coast from Maine to Florida. The proboscis contains a radula or flexible band set thickly with transverse rows of teeth. By rotating this the tender shells are readily bored and the soft parts of the oyster sucked out. The only effective means so far devised to combat them, and this is but partially successful, is the dragging of a mop of untwisted rope fibre over the oyster beds and close behind it a dredge. The drills stirred up by the mop fall into the dredge and are drawn to the surface and destroyed.

DRILLING, sowing in parallel rows as distinguished from sowing broadcast. It was introduced into England by Jethro Tull, who published a work on the subject in 1731. He saw that mere plowing and rough harrowing were not cultivation, but only its rudimentary operations and that the soil required to be stirred and pulverized, not only before sowing, but also after the plants had appeared above ground, in order that weeds might be extirpated and fresh particles of soil brought in contact with the roots of the crop. The plan of sowing in drills or ridges and hoeing in the intervals was therefore adopted by Tull as the best means to attain his objects. The advantage of sowing in drills has stood the test of experience and drill husbandry, by combining the advantages of continued tillage with those of manure and a judicious rotation of crops, is a marked improvement on the old mode of sowing all seeds broadcast. The crops which are now generally drilled are the grains, beans, peas, carrots, flax, etc. Drilling is of more importance on dry than on moist soils, as in the former weeds are more apt to spring up and injure the crops. See FARM MACHINERY.

DRILLS AND DRILLING. Drilling as a mechanical operation is often confused with boring. In machine shop practice, drilling is making a round hole through metal or the like with a rotating pointed tool, that forces its way through by pressure and rotation, taking off spiral chips of the material drilled and bringing them out of the hole through channels cut in the drill for clearance. Boring is enlarging a hole that already exists, as in a cast-iron cylinder, by turning the interior surface with a cutting tool. Cutting a circular hole in wood with a bit and brace, as done by carpenters, is boring, but a similar operation in metal is drilling. The forming of a hole in stone or rock, by repeated blows of a chisel or free-falling tool, as when making a hole for blasting or sinking an oil-well, is drilling. A hollow cylindrical tool for cutting out a core of rock is also called a drill. The forcing of holes in thin metal, as structural steel, by means of opposed dies and sudden pressure, is termed punching.

The machinists' drills are of two sorts: (1) Hand drills, which may resemble the carpenter's bit and brace except that a metal-cutting twist-drill serves for a bit; or which may be made on the ratchet-and-pawl principle, for working in confined spaces, as drilling a hole in the web of a section of laid railway track. (2) Power drills or drilling machines or drill presses — the latter being the more common catalogue name — which are of a great variety of forms, sizes and styles. They range from the light jeweler's drill, that makes a tiny perforation in a watch-case, to the heavy gang-

drill that cuts a dozen large holes at one operation in a heavy I-beam. The typical machinist's drill-press has an upright post with curved top like a letter f. At the overhanging top is a driving mechanism with a rotating chuck, made to hold securely any one of a series of steel drills of varying sizes and to position it perpendicularly for work. In the centre of the machine is a platform, usually swung lower than the cross-bar on the f, that is adjustable for height and arranged to swing in the arc of a circle, and to this platform the work to be drilled is clamped. When in position the operator lowers the drill by a lever, or wheel and worm motion, and throws on a belt to start the drill. When the hole is cut through he throws up the drill, and is then ready to repeat the operation.

The miner's drill is known as the rock-drill, and consists of a tripod frame, having an upright steam-cylinder, on the piston of which is mounted the drill, which is simply a hardened chisel arranged to rotate as it strikes the rock, so that the cutting edge is turned for every blow. Several hundred blows a minute may be delivered by this drill, which is the standard machine of the miner as well as the contractor, for forming holes for blasting rock. (See MINING AND MILLING MACHINERY). The oil-well drill or drilling rig, for sinking petroleum wells, operates on a similar principle, but a vastly larger and heavier outfit is required, as the hole has to go down perhaps hundreds or even thousands of feet. See PETROLEUM.

The diamond drill is used by prospectors to take out a core of rock that they may analyze its content and judge of its value. This tool has enabled mining companies to test their ore in the various levels, and thus know far in advance what they can depend upon for future reserves. The original diamond drill was a hollow cylinder with black diamonds on the lower edge for cutters. These being expensive a serrated edge of hardened steel was next tried. This was followed by the shot-bit or shotted drill. This bit is a soft steel cylinder in connection with which small chilled steel shot are used. The bit grinds the shot into the rock, thus gradually wearing it away by repeated minute crushings or small particles. The hollow drill rods are rotated and lowered by a machine solidly placed at the opening. The lower drill rod is surrounded by a "calyx" or cup-like tube and the two are joined at their lower ends by a plug. The centre portion of the plug serves as a bearing for a protecting ring and on its lower end a ring is threaded, while to this the core barrel is attached on which either the shot bit or the cutter can be threaded. The shot bit is provided with a series of triangular notches in its lower end, one of the walls of the notch being vertical and the other forming an angle of 30° therewith. The steel shot, which are fed through the hollow rods from the top, are carried by a current of water under this notch, and the inclined wall allows them to pass under the edge of the shot bit. The sizes of shot used vary with the nature of the rock to be drilled, some being as large as duck shot, though mostly finer. The working edge of the shot bit is rounded, so that the shot grinds not only directly beneath the drill, but also to a certain extent at the inner and outer sides, thus cutting out proper clearance for the operation of the drill. Water is pumped into the hollow drill-rods through a pipe and passes out under the bit and up the annular space outside the core barrel, carrying with it the sludge or fine particles ground up by the shot. The current of water flows with great strength up as far as the top of the calyx, where the annular space widens considerably, so that the current is reduced and the sludge it carries drops by gravity. See BORING.

DRIMYS, drī'mĭs, a genus of plants belonging to the family *Magnoliaceæ*. They are distinguished by their bitter, tonic and aromatic qualities. *D. winteri*, carried to Europe by Captain Winter from the Straits of Magellan in 1579, yields Winter's bark, which has been employed medicinally as an aromatic stimulant. It somewhat resembles canella bark. The bark of *D. granatensis* is used in Brazil against the colic. It is tonic, aromatic and stimulant. That of *D. axillaris*, a native of New Zealand, has similar qualities.

DRINK. See DIETETICS.

DRINKHOUSE, Edward J., American clergyman and author: b. Philadelphia, 1830; d. 1903. He joined the Maryland Conference of the Methodist Protestant Church in 1850. Failing health later obliged him to retire from the ministry and he went to California to recuperate. He received the degree of M.D. from Toland Medical College, San Francisco, in 1865. For 18 years he edited the *Methodist Protestant* and was one of the principal leaders in his church. He is the author of the important 'History of Methodist Reform Synoptical of General Methodism, 1703 to 1898, with Special and Comprehensive Reference to its Salient Exhibition in the History of the Methodist Protestant Church' (2 vols., 1899).

DRIPSTONE, a corona or projecting tablet or molding over the heads of doorways, windows, archways, niches, etc., to prevent rainwater from trickling down. Called also a label, weather-molding, water-table and hood-molding. The term label is usually applied to a straight moulding. Also a filtering stone, so called by sailors.

DRISLER, Henry, American classical scholar: b. Staten Island 27 Dec. 1818; d. New York 30 Nov. 1897. He was graduated from Columbia in 1839, was appointed tutor of Greek and Latin there in 1843, adjunct professor in 1845, professor of Latin in 1857 and of Greek in 1867. He was acting president of Columbia at the time of President Barnard's absence as one of the commissioners to the Paris Exposition in 1867 and again in 1888 and became dean of the School of Arts in 1894. He assisted Dr. Anthon in the editing of classical textbooks, prepared a new edition of Liddell and Scott's Greek lexicon and co-operated on the seventh Oxford edition.

DRIVER, Samuel Rolles, English biblical scholar and divine: b. Southampton, 2 Oct. 1846; d. 26 Feb. 1914. He studied at Winchester, and New College, Oxford, was for some years a Fellow and tutor of his college, and from 1876 till 1884 a member of the Old Testament Revision Company. In 1883 he was appointed to the Regius professorship of Hebrew at Oxford, at the same time becoming

canon of Christ Church. Among his numerous works may be mentioned 'A Treatise on the Use of the Tenses in Hebrew, etc.' (1874); 'Isaiah: His Life and Times,' (1893); Notes on the Hebrew Text of the Books of Samuel, (1890); 'Introduction to the Literature of the Old Testament' (1897), a work suited for popular reading, which has passed through a number of editions; 'Sermons on Subjects connected with the Old Testament' (1892); and commentaries on Leviticus (1894-98), Deuteronomy (1895), Joel and Amos (1897), Daniel (1900), Genesis and Exodus (1911). He was one of the editors of the 'Variorum Bible' (1880), and with Neubauer translated a series of Jewish commentaries on the 53d chapter of Isaiah. He was also joint editor of the 'Hebrew-English Lexicon of the Old Testament.' His presentation of the books of the Old Testament, based as it is on the results of the higher criticism, is at the same time informed with a reverential belief in their inspiration and religious authority.

DRIVER ANT, a nomadic predatory ant which makes its forays in column-like masses. The term usually refers to the well-known species (*Dorylus,* or *Annoma, arcens*) of western Africa; but the genus embraces several species scattered over Africa, and others in southern Asia and the East Indies. All belong to the formicid sub-family Dorylinæ, which also includes the highly destructive visiting, or foraging, ants (*Eciton*) of tropical America. The driver ants are reddish brown, and in general (i.e. the workers and soldiers of various castes) small, rarely exceeding one-third of an inch long; but the females and males are huge, ungainly creatures an inch and a half in length. All except the procreative males are totally blind. Most of the species live almost continuously underground; but the celebrated West African driver (*Dorylus arcens*) has a more exposed manner of life. Its colonies construct no fixed home underground or elsewhere, but move about incessantly, taking shelter during the days in crevices of rocks, under logs, and so forth. Frequently they climb trees, and then hang in clusters, or in long chains that grow until they find an attachment for the lower ends when they serve as ladders up and down which other ants climb.

When they move on one of their expeditions they go at night or in cloudy weather. If detained abroad collecting food until the morning sun is shining, they will construct an arch over their path, as they proceed, of dirt agglutinated by a fluid excreted from the mouth. They march in an army-like column of millions of individuals, which «looks like a thick rope,» and is flanked by lines of watchful «soldiers.» Against an excursion of these desperately pugnacious little insects, nothing avails on the part of any beast of the forest but instant flight. «The most fierce and powerful animal,» Hamilton asserts, «and the most deadly snake, become, in the face of their attack, mere panic-stricken fugitives, rushing vainly for relief to the nearest water, or desperately rolling on the earth in their endeavors to free themselves from the torture of a million poisonous bites.» Animals tied or confined in pens or cages, such as calves, pigs or fowls, will be killed and stripped of flesh to the bones, as has often happened; and a sleeping man wakened by such an onslaught will have hard work to save his life. A sick man, or an infant, will perish. Dr. T. S. Savage, the celebrated American missionary to the Gaboon region, who first described the gorilla scientifically, had much experience with invasions of his premises by these ants. The first effect of their entrance into a house is the flight or capture of rats, cockroaches and every sort of vermin. Insects, indeed, form their principal and ordinary fare. They ransack the building in regular order, searching for food, preferring fresh meat and fresh fruit-oils, and not touching sugar, milk, pastry and salted meat. When the place is «looted» to their satisfaction the whole army leaves it completely and goes on. These habits characterize this West African species in particular. Other species are not so migratory or predaceous. Consult Savage, 'Proceedings,' Academy of Sciences, Philadelphia (Vol. IV, 1847); Wheeler, 'Ants' (New York 1910); Hamilton, 'Animal Life in Africa' (New York 1912).

DRIVING. Since the advent of the automobile, driving has fallen off, and there are fewer and fewer people who know how to drive a horse or a team. A driver should always grasp the reins before mounting to his seat, so that if the horse should start before he is ready, he may have control. Both lines or reins should be held in the left hand, with the elbow at the hip and the hand well in front, thumb up. The left line should be grasped between the thumb and forefinger, the right line between the second and third fingers. The whip should be held in the right hand, which may also be used to grasp the right line, when it is necessary to use more strength. The whip should not be used as an instrument of torture, and the spur is a relic of barbarism. A good driver uses the whip to indicate to the horse when more speed is desired, and if he does not mind the hint, gives one sharp cut along the horse's groin, but never descends to beating the animal. A horse should always be started at a very moderate jog, and the speed increased by degrees until the desired pace is attained. Systematic touches with the whip will soon educate a horse to what is desired in this respect. Horses, like people, have all sorts of dispositions, and like people they can be managed easily by firmness, good sense, and fair treatment. Good driving involves good harnessing, and a driver should know when a harness is properly adjusted, and when it is a poor fit. He should know how far from the dash the horse should stand when the traces are taut, and see that the collar fits, and that the breeching is properly buckled. See HORSES, RIDING AND DRIVING.

DROGHEDA, droh'ĕ-dä, Ireland, seaport in the southeast of county Louth; on the river Boyne, four miles from its mouth; 32 miles north of Dublin, and 81 miles south of Belfast. It does a large export trade with Liverpool, and there are important textile industries. In 1494, the Irish parliament, then in session at Drogheda, passed under compulsion, the «Poyning's laws,» sometimes called the «Statutes of Drogheda.» In 1649, Cromwell stormed the city and massacred the garrison. William II took possession of the city the day after the «Battle of

the Boyne.» Pop. 12,501. See POYNING'S LAW.

DROHOBYCZ, drō-hô'bĭch, Austria, town in Galicia, 41 miles south-southwest of Lemberg. Its public buildings include a castle, surrounded by extensive grounds, and a handsome Gothic parish church of the 14th century. It has an important trade, chiefly with Hungary, in corn, leather, linen, earthenware, paraffin, petroleum, and particularly salt, obtained from salt springs in the vicinity. Near the town are valuable iron mines and pitch wells. Pop. 34,665.

DROITWICH, droit'ich, England, market town, six miles northeast of Worcester, on the banks of the Salwarp, and on a canal connected with the Severn River. Droitwich is supposed to have been the Salinæ of the Romans, and some Roman remains have been discovered. It is still famous for its brine springs, rising near the centre of the town through strata of red sandstone and gypsum from a depth of 200 feet, which contain between 35 and 40 per cent of pure salt, and yielding annually over 100,000 tons of salt. From these celebrated wyches, or brine springs, as appears from grants to the church of Worcester, salt has been manufactured for more than 1,000 years. Pop. 4,146.

DROME, drōme, France, a southeastern department, covered almost throughout by ranges of the Alps, the average height of which, however, does not exceed 4,000 feet; area, 2,532 square miles. Drôme is bounded on the west by the Rhone, and the most notable of the rivers, the general direction of which is westward toward the Rhone, are the Drôme and the Isère. The surface is most mountainous toward the east, a spur of the Alps traversing the eastern limits and from this spur numerous smaller ranges shoot off westward across the entire area of the department. The climate is cold, with piercing winds. The highlands are covered with forests of pine, oak, beech and chestnut, and in the mountainous regions are found valuable deposits of iron, copper, lead, coal and marble. Oats, wheat and potatoes are the principal crops; sheep and cattle are raised. The staple productions are chiefly wines, olives, grapes, chestnuts, and silks. Much attention is given to the cultivation of chestnut, walnut, mulberry, and olive trees and vines. The manufactures comprise hosiery, silk, cotton and woolen goods, serge, etc. Valence is the capital. Pop. 290,894.

DROMEDARY, a camel, either one-humped or two-humped, of a breed and training fitting it for use as a speedy saddle-animal. See CAMEL.

DROMGOOLE, Will(iam) Allen (Miss), American author and newspaper woman: b. Murfreesboro, Tenn. Since 1904 she has been a staff member of the *Nashville Banner,* having served as educational editor and as literary editor, and furnishing a regular feature known as Song and Story. She is the author of 'Heart of Old Hickory'; 'The Valley Path'; 'The Farrier's Dog and His Fellow'; 'Adventures of a Fellow'; 'Three Little Crackers from Down in Dixie'; 'Hero Chums'; 'Rare Old Chums'; 'A Boy's Battle'; 'Cinch and Other Stories of Tennessee'; 'The Best of Friends'; 'The Moonshiner's Son'; 'Harum-Scarum Joe'; 'The Island of Beautiful Things'; 'Old Thunder' (1916); and two plays 'The Tennessean' and 'A Nice Little Girl.'

DROMIOS, The, two characters in Shakespeare's play the 'Comedy of Errors.' They are twin brothers of close resemblance, who had been separated early in life, and who meet as the respective attendants of Antipholus of Ephesus and Antipholus of Syracuse.

DROMOCYON, a genus of creodonts (q.v.) typical of the family *Mesonychidæ,* existing in the Middle Eocene era, and found fossil in complete form in the Bridges formation of the Rocky Mountain region. They were long-jawed, wolf-like, fast running creatures, with heads somewhat hyena-like, blunt grinding teeth, and broad, almost hoof-like claws. It is supposed that they fed mainly on carrion.

DRONE. See BEE.

DRONE-FLY, a dipterous insect (*Eristalus tenax*) of European origin, but first described as an American fly in 1870. It prevails from the Atlantic to the Pacific, and so closely resembles the honey-bee in size and color, that the two are often confounded. Living on the juices of flowers, particularly upon those of agreeable fragrance, it hovers about dwellings and windows late in the autumn.

DRONGO, or **DRONGO-SHRIKE,** a passerine bird of the family *Dicruriæ,* represented by many species in Africa, Southern Asia, and Australia. The typical and most familiar species is the Indian *Dicrurusater.* Of a glossy black color, it has the stout, hooked bill and forked tail of the shrike. Its food consists of insects, which it often captures on the wing. In India it is a common bird, where by Europeans it is called "king-crow" from its habit of routing crows and other large birds in defense of its nest.

DRONGO CUCKOO (*Surniculus dicruroides*), an East Indian bird of the order *Picariæ.* It is especially interesting to biologists as a conspicuous example among animals of imitation, according to which one group of animals gradually assumes some characters of another and a different group, when such features are advantageous. Structurally, the drongo cuckoo is true to the picarian order, having the yoked toes — two in front and two behind, — and resembles the cuckoo, of the same order, in its habits of nesting and of egg-laying. But in other respects it exactly imitates the drongo-shrike, having the same description of plumage and color, with the furcated tail, and inhabits the same locality.

DRONTHEIM, drōnt'hīm. See TRONDHJEM.

DROOGENBROECK, droo'gĕn-brĕk, **Jan van,** Flemish poet: b. Saint Amand-on-Scheldt, 18 Jan. 1835. He was long an educator of eminence, having been for over 22 years a tutor and professor at a prominent school of music in Brussels. He issued his first verse collection 'Ghazels and Makames' (Arabian terms for stanzas and songs) in 1866, under the pseudonym of JAN FERGUNT; his subsequent volumes, on Camoens and other important subjects, fully sustaining his reputation. The most important of his subsequent works are the treatise entitled 'De Toepassing van het Grieksche

en Latijnsche Metrum op de Nederlandsche Poëzie' (1886), for which he received a prize at Brussels; and 'Dit zijn Zonnenstralen' (6th ed. 1884), some popular poems of childhood. He also wrote the libretto to the opera 'Undine' by Lortzing, which was performed for the first time in 1862.

DROP FORGING. See MACHINE FORGING.

DROPPERS, Garrett, American educator: b. Milwaukee, Wis., 12 April 1860. He was graduated at Harvard 1887, and later studied at the University of Berlin 1888–89. From 1889 to 1898 he was professor of political economy and finance in the University of Tokio, Japan. He was secretary of the Asiatic Society of Japan and contributed to its 'Transactions' several important and valuable articles on Japanese currency questions. From 1898 to 1906 he was president of the University of South Dakota at Vermilion, S. D., and since 1907 has been professor of economics at Williams College. In August 1914 he was appointed United States Ambassador to Greece. He has published a 'Translation of Schopenhauer's Essays' (1881).

DROPSIE COLLEGE, Philadelphia, an institution for the advanced study of Hebrew and cognate subjects founded by Moses Aaron Dropsie in 1895. It has a fine library covering biblical and rabbinical subjects, Semitic languages and Jewish history, the number of volumes and periodicals amounting to about 17,775. The degree of Ph.D. is awarded for special research in one particular branch of these studies. The students in 1917–18 numbered 26; the faculty and officers, 12. Six fellowships are maintained.

DROPSY consists of an accumulation of lymph-like fluid in the subcutaneous tissues and serous cavities of the body. A number of names may be used to designate the fluid accumulation, such as hydrops, when in body cavities; edema, when the fluid is in the lymph spaces; ascites when in the peritoneal cavity. Furthermore, localized forms of dropsy have received special names, such as dropsy in the abdomen — ascites; dropsy of the chest; hydrothorax; dropsy of the testicle, hydrocele; dropsy in the brain, hydrocephalus. The main causes for the symptom called dropsy are (*a*) insufficient strength of heart-action, allowing the serum of the blood to wander outside the blood vessels, and (*b*) some obstruction, preventing the return of the blood to the heart. (*c*) Some acute or chronic inflammation of the organ itself. Thus in many forms of hydrocephalus there is an inflammatory exudate from the choroid plexus of the brain. (*d*) Some acute toxic process may bring about severe edemas, such are seen in the so-called anaphylactic reaction. The most important cause of dropsy is some disease of the heart and blood vessels whereby there is either increased forward or arterial pressure, or increased backward or venous pressure. The latter is of more importance than the former. Some vital alteration in the walls of the capillaries is important in bringing about the phenomena. The treatment of dropsy is technical to a high degree, inasmuch as the causes are frequently obscure. (See HEART DISEASE). Consult article on Edema, in 'Reference Handbook of the Medical Sciences.'

DROSERACEÆ, drŏs-ę-rā'sę-ē, the Sundew family, marsh plants and natives of temperate and warm climates. They are herbaceous rosette plants with glandular hairs on the leaves for the capture of insects. The family has six genera and about 125 species, known throughout the world. Among members of the family are Venus flytrap (*Dionæa muscipula*) (q.v.), and Parnassia. The family is represented in America by the typical genus of the order *Drosera,* which has about 110 species, most abundant in Australia, and found also on the heaths and moors of England. Seven species of the sundews are found in various parts of North America.

DROSKY, drŏs'kĭ, **DROSHKY,** or **DROSCHKY,** a kind of very small, light, four-wheeled carriage used by the Russians. It is not covered and in the middle there rises a sort of bench placed lengthwise. The driver generally throws one leg on each side of this bench, but the conveyance is also capable of holding two persons. The wheels are covered with wings, which keep off the mud. The term is now applied to several other kinds of vehicles.

DROSOMETER (from the Greek *drosos,* dew, and *metron,* a measure), an instrument for ascertaining the quantity of dew which falls. It consists of a balance, one end of which is furnished with a plate fitted to receive the dew, the other containing a weight protected from it.

DROSSINIS, drô-sē'nēs, **Georg,** Greek poet: b. Athens, 21 Dec. 1859. He studied for the law, but later abandoned the practice for literature. He was for sometime editor of the *Hestia* in Germany. He has published five volumes of lyrics. 'Spiders' Webs' (1880); 'Stalactites' (1881); 'Idylls' (1885); 'Straw Flowers' (1890); 'Amaranths' (1891); also some stories and other minor works in prose. A charming simplicity of language characterizes all his works.

DROUAIS, droo'ā', **François Hubert,** French artist: b. 1727; d. 1775. He was the son of Hubert Drouais (q.v.) and studied under Van Loo, Natoire and Boucher. He was noted for his portraits, which because of their graceful delicacy made him the most popular artist of the time. He became court painter and councillor of the Academy. He numbered among his sitters Madame du Barry, Madame de Pompadour and Mademoiselle Helvetius (at the Metropolitan Museum). His pictures are characterized by the same affectation and polished charm which marks his era.

DROUAIS, Hubert, French miniature painter: b. La Rocque, 1699; d. 1767. He studied under De Troy in Paris, and became court painter in 1744. Most of his works are in private collections. The Louvre possesses two portraits by him.

DROUAIS, Jean Germain, French painter: b. Paris, 25 Nov. 1763; d. Rome, 13 Feb. 1788. He was a pupil of David and having gone to Rome to study was, in 1784, successful in carrying off the great prize, his subject on that occasion being, 'The Canaanitish Woman at the

Feet of Jesus.' His 'Dying Gladiator,' and particularly his 'Marius at Minturnæ,' on being exhibited in Paris, gained for him and David's school a new triumph.

DROUET, Henri, droo'ā', French naturalist; b. Troyes 1829; d. ——. He became known by his researches in natural science and in 1855 published 'Enumération des mollusques terrestres et fluviatiles vivants de la France continentale,' due to his travels, examining government and private collections throughout France and his personal observations, which were extended in 1857 by a scientific journey through Portugal. He held a government position in the departmental administration from 1858 to 1870. The chief of his further publications are: 'Les mollusques terrestres et fluviatiles de la Guyane française' (1859); 'Sur terre et sur mer' (1870); and 'Alger et le Sahel' (1887).

DROUET, droo-ā, Jean Baptiste, Comte d'Erlon, French marshal: b. Rheims, 29 July 1765; d. Paris, 25 Jan. 1844. Entering the army as a private in 1782, he saw active service in 1793–96 and became aide-de-camp to General Lefèvre, and he was appointed brigadier-general in 1799. In the following year he was made general of a division which was active in the campaign of 1805–07, especially at Jena and Friedland, where he was wounded. His services won for him the Grand Cross of the Legion of Honor and elevated him to title of Comte d'Erlon. His conduct in the Peninsular War was highly distinguished. After the fall of Napoleon he was arrested on the charge of conspiring against the royal family. On the return of Napoleon from Elba he contrived to seize the citadel of Lille, in which he had been imprisoned and held it for the Emperor, who made him a peer of France. At the battle of Waterloo he commanded the 1st corps d'armée. After the capitulation of Paris he fled to Bavaria, where he resided till the July Revolution, when he returned to France and received in 1832 the command of the army of Vendée. During 1834–35 he held the office of governor-general of Algeria, and in 1843 was elevated to the rank of marshal. Some autobiographical notes appeared in 1844.

DROUYN DE LHUYS, droo-ăń dė lü-ēs, Edouard, French statesman: b. Paris, 19 Nov. 1805; d. there 1 March 1881. He studied law at the Ecole de Droit, and in 1831 became an attaché to the Embassy at Madrid. He represented France at The Hague (1833–36) and was appointed First Secretary of the Embassy at Madrid. In 1840 he was placed at the head of the commercial department under the Minister of Foreign Affairs, and shortly after was elected deputy for Melun; but he afterward was deprived of his office because of his opposition to the government by Guizot. Under Louis Napoleon's presidency he became Minister of Foreign Affairs. After the *coup d'état* he became one of the vice-presidents of the Imperial Senate, and again Minister of Foreign Affairs. In 1855 he resigned his office; in 1863 he was recalled to his old post, resigning again in 1866. He wrote a work entitled 'Les neutres pendant la guerre d'Orient' (Paris 1868). His 'Mémoires' were published in the collections of the French academy of Moral and Political Sciences.

DROWN, Thomas Messinger, American educator: b. Philadelphia, Pa., 19 March 1842; d. Bethlehem, Pa., 16 Nov. 1904. After graduating in medicine at the University of Pennsylvania in 1862 he pursued the study of chemistry at Yale, Harvard and Heidelberg for seven years, from 1874–81, occupied the chair of analytical chemistry at Lafayette College, and for 10 years a similar chair at the Massachusetts Institute of Mining Engineers. He was one of the founders of the American Institute of Mining Engineers, and served with marked efficiency for 10 years as its first secretary and editor of its 'Transactions,' being later elected to honorary membership and in 1897 to its presidency. Dr. Drown did very important original work in quantitative analysis both in metallurgy and in sanitary chemistry. In 1895 he was called to the presidency of Lehigh University, and by careful and intelligent guidance placed it in its present high position among American schools.

DROWNED COASTS. See SHORE LINES.

DROWNING, a form of asphyxia induced by submergence in water or other fluid. As a rule in drowning the body is submerged, but Peterson and Haynes in their recent 'Legal Text-book' relate the case of an epileptic patient who, while walking on a low, sandy beach, fell in a paroxysm with his face down, causing by his spasmodic movements a small excavation of an inch and a half in depth in the sand beneath his face. This small depression filled with water and he was found dead from asphyxia about an hour or more after the occurrence. Most cases of drowning result from asphyxia, by which is meant the body becomes poisoned from the lack of oxygenation of the blood, since no oxygen can enter the lungs from the fluid, in a form that can be utilized. Heart failure sometimes occurs in drowning. At one time drowning was a legal method of execution and prevailed in England until the early part of the 17th century; it was much practised in other European countries during the Middle Ages, and is still practised in Mohammedan countries and in the Far East. (See CAPITAL PUNISHMENT). It is a frequent method of suicide, fully one-third of the cases taking this method. Danger from drowning to swimmers depends very largely upon the ability of the swimmer, although this is not a guarantee of safety, since many excellent swimmers have been known to be unable to sustain the fatigue of being long in the water and sometimes succumb suddenly from muscular cramps or from attacks of syncope. Persons who have respiratory defects, such as asthma or stammering, or who have organic disease of the circulation, are more liable to drown. Drowning occurs more often among men than among women, because of the greater amount of exposure. Extreme coldness of the water seems to be an important factor in augmenting the danger from drowning. Good health, muscular vigor and calmness of mind are of great importance in cases of danger from impending drowning. With reference to the symptoms there is great variability. Some people who have been submerged suddenly and in water of low temperature are found dead on almost immediate rescue. Here probably the nervous shock and deficient heart action accounts for

the result. In a great many more cases, however, there is spasmodic closure of the glottis from direct irritation of the water as it enters the nose and mouth and from nervous reflexes due to sudden chilling of the surface. Many of these patients sink to the bottom at once and remain below the surface, unconsciousness occurring in the course of a few seconds. The respiratory movements are few and convulsive and the heart stops. In the greater number of cases, however, asphyxia results from the entrance of water into the lungs; the individual struggles to come to the surface and as soon as the surface is reached attempts are made to fill the lungs by long inspirations. This very frequently draws a small amount of water into the larynx and then involuntary convulsive efforts result. With each convulsive inspiration more water is drawn in and thus pulmonary congestion becomes more and more pronounced. The struggle for life becomes violent and the patient frequently grasps at everything in sight, even tearing handfuls of mud from the bottom of the body of water. During the convulsive seizures the face becomes blue, the eyes bulge, the features become contorted, the pulse rapid and feeble. Ofttimes the bladder and rectum are emptied. After a few minutes, five or six, respiration ceases; four to six minutes more, sometimes longer, the heart continues to beat, gradually failing in strength and rapidity.

Treatment of all cases of drowning should be insistent and prolonged. If there is a great deal of water in the chest, the chances are lessened. Instances have been recorded in which patients have been submerged 20 or 30 minutes and have recovered, but if the body has been beneath the surface for over 4 or 5 minutes the general chances of resuscitation are slight. If attempts at resuscitation are made — and they should always be made unless the body has been under water several hours — the body should be placed face downward, the head and shoulders depressed, so as to favor drainage of water from the lungs and all efforts should be directed at first toward the restoration of breathing. The application of hartshorn, smelling salts or snuff to the nostrils, tickling the throat with a feather, dashing cold water and hot water alternately on the chest and face and vigorous friction of the upper part of the body to create warmth are of value, as also wiping and cleansing the mouth; surrounding the patient with hot bottles; and hot rectal irrigations of salt solution or whisky. If these preliminary efforts fail, artificial respiration should be resorted to and continued for several hours. The patient should be still kept face downward, a folded coat or other article of dress raising and supporting the chest. The weight of the body on the chest forces the air out, then turning the body well over but gently on one side, then turning it on its face again, repeating these movements about 15 times in a minute, occasionally varying the side, at each turn and relief of the chest pressure, air enters the lungs and excites breathing. This operation should be assisted between each turn of the body by brisk and uniform pressure between and below each shoulder-blade. At the same time, but without interfering with these operations, the hands and feet should be dried, wet clothing removed and the body enveloped in warm blankets or reclothed with dry garments. Should these efforts prove unavailing after from two to five minutes, recourse should be had to Dr. Silvester's method, which consists in placing the patient on the back, on a flat surface inclined slightly upward from the feet, the head and shoulders being raised and supported on a small cushion, or folded article of dress placed under the shoulder-blades. The tongue should be drawn forward and fastened by an elastic band, string or tape over the tongue and under the chin, to keep it projecting beyond the lips. Then to imitate the movements of breathing and to draw air into the lungs, stand at the patients's head, grasp the arms just above the elbows and draw the arms steadily upward above the head, keeping them stretched upward for two seconds. To expel the air from the lungs, turn down the arms and press them firmly for two seconds against the sides of the chest. Repeat these movements deliberately and persistently about 15 times a minute, until a natural effort to breathe is perceived, when the efforts should be turned toward inducing circulation and warmth, which can be best promoted by briskly rubbing the limbs upward with flannels, etc., thus propelling the blood along the veins to the heart and by the application of hot flannels, hot water bottles, heated bricks, etc., to the pit of the stomach, between the thighs, the armpits and to the soles.

Another method which has the advantage of simplicity and can be applied by one person is that of Dr. Benjamin Howard of New York. The body is placed face downward with a roll of clothing under the stomach, one arm being bent upward so that the hand supports the forehead. To expel the water from the chest, the body is pulled feet downward over the roll of clothing. Then turn the body on the back, with the roll of clothing under the shoulders, so that the head falls back, thus stretching the neck. Kneel over the body, one knee pressed firmly against either thigh. With both hands spread over the lower part of the chest, so that the thumb hooks in under the lowest ribs on each side, press forward steadily with the weight of the body on the arms, thus raising the ribs, enlarging the chest cavity and causing the air to enter. When the ribs have been pushed upward to their utmost extent, release them gently by a receding movement, allowing them to return to their original position, thus expelling the air. Repeat this process until respiration is restored, then resort to the methods already mentioned to induce circulation and warmth. No attempts at resuscitation should be abandoned until all efforts seem to be absolutely futile. See Asphyxia; Pulmotor; Respiration, Artificial.

DROWSINESS. See Sleep.

DROYLSDEN, droilz'dĕn, England, town in Lancashire, five miles east of Manchester, of which it is an outlying suburb. It contains large cotton manufactories, copperas, chemical, and dye works, and print mills. Pop. 13,259.

DROZ, drō, **François Xavier Joseph,** French moralist and historian: b. Besançon, France, 31 Oct. 1773; d. Paris, 5 Nov. 1850. In 1806 he published 'Essai sur l'art d'être heureux' (1801) which was very popular; and in 1823 'Philosophie morale' which procured

his admission into the Academy. His reputation is, however, founded chiefly on his 'Histoire du règne de Louis XVI.'

DROZ, Gustave, French novelist: b. Paris, 6 June 1832; d. 31 Oct. 1895. He was trained for a painter, but in 1864 gave up the pencil for the pen. The extraordinary success of his first volume of stories 'Monsieur, Madame, et Bébé' justified the change. He excelled in little sketches of life and manners, and his lively, playful descriptions of bachelorhood and married life captivated the public. His novel 'Autour d'une source' (1869) is generally considered his best.

DROZ, Pierre-Jacquet, Swiss mechanician: b. La Chaux de Fonds, Switzerland, 28 July 1721; d. Bienne, Switzerland, 28 Nov. 1790. Aspiring to be something more than a mere workman, he succeeded in attaching to common-time pieces, at a small expense, machinery which produced music resembling the chime of bells, and the music of a flute. His attempts to discover the means of effecting a perpetual motion led him to important discoveries. He contrived, among other things, a pendulum, which being composed of two metals of unequal expansibility, remained unaffected as to its length and time of vibration by heat or cold. He afterward made his celebrated writing automaton, which, by means of machinery contained within the figure, was made to move its fingers and hands, and to form handsome letters.

DRUG, a name applied to all substances, vegetable, animal, or mineral, used for medicinal purposes, though the term should, perhaps, be strictly confined to what are called simples, balsams, gums, resins, and exotic products used as medicaments in a dry state. The name is also applied to dyeing materials and those used in tanning and other arts. See PHARMACY.

DRUG HABITS. Recent investigations of the United States Department of Agriculture show conclusively a constantly decreasing use of injurious drugs (exclusive of alcohol and tobacco) among the people of this country. Before any means were available for gathering authoritative figures, the estimates of the number of drug habitués in the United States ranged as high as 4,000,000. But the report of the Food and Drugs Commissioner of Tennessee on the first year's (1913–14) operation of that State's anti-narcotic law provided definite statistics, which have been accepted by the Government's experts as a fair basis for a close estimate. Applying to the whole country the ratios gained in the Tennessee records, the total number of drug addicts in the United States would be about 118,000. A check upon these figures is supplied in the amount of habit-forming drugs imported into the United States. The Bureau of Chemistry points out that if nine-tenths of all the opium imported into the country were consumed by addicts at the rate of the Tennessee consumption, the number of such users would be 187,000. The same Bureau estimates that all of the importation of cocaine is consumed by addicts at the rate of one ounce per person per year, and that the 150,000 ounces imported annually indicate 150,000 users. This estimate is combated by hospital physicians who declare that many cocaine eaters and snuffers consume as much as 15 ounces annually. The American Pharmaceutical Association estimates that the total number of drug habitués (exclusive of those addicted to alcohol and tobacco) in the United States in 1914 did not exceed 200,000.

Of the whole number of drug users those addicted to morphine amount to 37.6 per cent; to cocaine, 26.7 per cent; to laudanum, 18.8 per cent; to heroin, 4.4 per cent; to gum opium, 2.2 per cent; and those who have both morphine and cocaine habits, 10.3 per cent. Further official investigation as to the origin of drug habits show that 54.6 per cent had their beginnings in physicians' prescriptions; 21.6 per cent in the advice or persuasion of drug-using acquaintances; 21.6 per cent as a result of dissipation; 2.4 per cent in the desire to escape suffering in incurable diseases.

The drugs used by victims of drug habits are of two general groups: (1) sedatives, and (2) stimulants. The first group includes the soporifics, such as chloral, sulphonal, veronal, etc., and the analgesics and anæsthetics, such as opium, cocaine, cannabis Indica (Indian hemp or hasheesh), etc., and the headache-powder constituents, phenacetine, acetanilid, antipyrine and its derivatives, bromopyrine, salipyrine, etc., and antifebrin and its derivatives, phenalgin and exalgin. The second group includes alcohol, tea, coffee, tobacco, etc. In the second class should be included also opium in doses of a certain small quantity relative to the degree of habituation, in which it is highly stimulating. This is true also of the delirium produced by Indian hemp. Coca and cocaine are stimulants in small doses, which, however, speedily require to be made larger. It is for this reason largely that the cocaine habit is regarded as the most insidious and dangerous. The effect of the drug soon passes off, and repeated as well as larger doses are sought by the victim. A debased mental condition follows the brief exhilaration, and a tendency to suicide is developed.

Tea, coffee, cocoa, kola, maté, guarana, etc., depend for their attraction upon their active principles, caffeine, theobromine, or theophyllin. The effect of these drugs is similar to that of cocaine, though in a much less degree. They all develop neurotic tendencies in the users. In most cases the system becomes tolerant of the drug, and, the effects being cumulative, the eventual breakdown is sudden.

The foundation of drug habits is very often laid with soothing syrups given to babies. These have been found to contain opium, morphine, heroin, codeine, chloroform, chloral hydrate, and cannabis. The habits thus begun are nurtured with patent medicines. Asthma remedies contain practically the same series of drugs as the soothing syrups, with the addition sometimes of tobacco. Catarrh cures are largely cocaine, either in powder to be used as a snuff, or in liquid form as a spray. Remedies for coughs and colds contain chloroform, heroin, morphine, codeine, cannabis, and ether. Headache remedies consist of acetanilid, acetphenetidin, antipyrine, caffeine, etc., in various combinations. Epilepsy cures are chiefly bromides, with morphine or opium. Many tobacco-habit cures contain cocaine, and, indeed, almost all of the cures offered for the various drug habits have proved to be preparations of the same drug to which the habitué was addicted.

In the endeavor to check the spread of this pernicious use of dangerous drugs, the Federal Government in 1910 issued the first of a series of pamphlets through the Department of Agriculture warning the people against the use of habit-forming drugs, and calling particular attention to the drinks containing cocaine served at many soda fountains. Prior to the appearance of this bulletin, the Federal authorities had forbidden the sale of certain popular beverages for this reason, and the manufacturers were not permitted to supply orders again until they had changed their formulas to the satisfaction of the Bureau of Chemistry.

In view of Secretary Wilson's charge that druggists, physicians, and patent medicine manufacturers were largely responsible for the development of drug habits, the revision committee of the American Pharmaceutical Association, which met in May 1911, investigated and passed unfavorably upon a number of the so-called "remedies."

Both the Federal authorities and the health officials of the several States began a definite campaign against the sale of pernicious drugs along the following lines:

(1) To educate the public through the press as well as by lectures, pamphlets, etc. (2) To secure the enactment of laws forbidding the sale of habit-forming drugs, and preparations containing them, except on the prescription of duly authorized persons. (3) To require a permanent record to be kept of all transactions in such drugs, whether by prescription or otherwise, the same to be subject to Federal and State inspection at all times. (4) The enactment of laws forbidding the handling of such drugs, except by druggists, manufacturers, and others legally qualified. (5) To secure the passage of laws permitting State Boards of Health to revoke the licenses of physicians or druggists convicted of selling such drugs for other than legitimate purposes. (6) To secure the passage of a Federal law prohibiting the interstate shipment of habit-forming drugs, or preparations containing them, except through the regular channels of trade in which records of all transactions must be kept. In 1914 the so-called Harrison bill was passed by the United States Congress, and it went into effect 1 March 1915. It requires that "every person who produces, imports, manufactures, compounds, deals in, dispenses, sells, distributes, or gives away opium, or coca leaves, or any compound, manufacture, salt, derivative, or preparation thereof" shall register with the collector of internal revenue of the district, and pay an annual special tax of $1. Every sale is to be recorded with the patient's or purchaser's name, age, and address, together with the name of the dealer or physician and the date. It is made unlawful for any dealer or druggist to supply an opiate unless all the requirements have been fulfilled. Exceptions are made in the case of preparations which do not contain more than two grains of opium, one-quarter grain of morphine, one-eighth grain of heroin, one grain of codeine, or any salt or derivative of them in one fluid ounce, or, if solid or semi-solid, in one ounce avoirdupois. This exception has been sharply criticized, since it has been shown that prescriptions of the strength exempted will readily supply the usual 2-grain dose to an addict if he takes an ounce at a time.

Several of the States have passed similar laws, and the immediate effect has been to curtail illicit sales of these drugs to a very considerable degree. In nearly all of the States these drugs can be procured only on a physician's prescription, and in some it is unlawful even for a physician to supply such drugs to addicts except in regular professional treatment of disease. In a few of the States these habit-forming drugs are classed as poisons, and may be sold if provided with a poison label. In Louisiana chloroform and hyoscyamus are included among the forbidden drugs. The drug law of Michigan forbids any person except a physician to receive or have in possession any cocaine, alpha eucaine, or beta eucaine, or any of their salts, even as an ingredient of some other preparation. The law of West Virginia makes it a felony to dispense cocaine to addicts.

In China, where the opium habit has held sway since the 13th century the fight against the habit began with the Imperial Edict issued in 1729 against opium smoking. In 1796 an edict was issued forbidding the importation of opium, which then came from India. The Chinese set diligently to work cultivating the poppy, and notwithstanding the death penalty decreed to opium smokers, the trade continued.

India has always been one of the large producers of opium, and England has steadily maintained that, so long as China produced most of the opium used in that country, and even exported it to other countries, there was no justification in the demand that exports of Indian opium to China be forbidden. Even when China had announced her intention of suppressing the trade, many statesmen in England questioned the sincerity of that declaration.

In 1905, however, the influence of the anti-opium societies became so great that the Imperial Senate was compelled to pass drastic laws against the opium traffic. In 1906 China produced 330,000 piculs of opium — a picul being equal to 133⅓ pounds avoirdupois. She also imported 51,000 picules from India. The government decreed that both the cultivation of the poppy and the use of opium must cease.

In 1910 the area devoted to poppy culture had decreased from 614,000 acres (in 1906) to 350,000 acres, and the production of opium had been reduced by more than 25,000,000 pounds. The reports from the five principal opium-using provinces show that the number of shops in which opium is sold has been reduced from more than 42,000 to about 12,000. The number of users of the drug (13,000,000 in 1906) has also been largely reduced and is steadily declining. To promote this condition, hundreds of public "refuges" for the scientific treatment of victims of the opium habit have been established in China. In 1910, it was reported that nearly 1,200,000 cures had been effected; nearly 1,500,000 patients were then undergoing treatment.

In 1912 the National laws against the cultivation, sale and smoking of opium went into effect with the support of nearly every newspaper in China. Large quantities of opium were burned, as much as $10,000 to $15,000 worth being consumed in a single fire.

One of the most serious obstacles to be surmounted by the anti-opium societies has

been the existence in China of a stock of Indian and Chinese opium valued at $70,000,000, upon which large loans had been advanced by the banks. See CHLORAL; COCAINE; INTOXICATION; OPIUM; TOBACCO.

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DRUG TRADE. The American drug trade is largely a modern development, although America's part in the history of drugs dates from the days of the first explorers. When from the Americas travelers returned to the Old World bearing with them specimens of the various products of this new world, the learned men of Europe greeted their arrival with interest and science hastened to affirm that the chief advantage to be derived from the discovery of the new continent would lie in the introduction of new and more potent drugs. From that moment scientists began to devote their attention to the study of American plants and herbs, and all the old chronicles show a considerable space devoted to a recital of the health-giving qualities of these products of the American soil. Nothing that grew in the New World was neglected by the experimenters. Everything was tested, and many things were found to be of great value. For a long time tobacco, Jesuits' bark, and sassafras, were among the most frequently used medicaments, and, from time to time, the medicinal properties of other herbs were discovered and utilized.

The drug trade itself has no such ancient record to which one may revert. A century ago the stock of every wholesale druggist included such articles as glassware, oils, paints, putty, indigo, madder, etc., and sometimes even commodities still more foreign to the trade. Since the early part of the 19th century, however, the wholesaler has improved his commercial position by restricting his stock to such articles as may be classified as true drugs or medicines. These articles, of course, include many "patent" medicines, and will probably do so as long as the demand for such preparations continues to make them one of the most important items in the drug trade.

From the beginning of the history of medicine and pharmacy the people as a mass have been conspicuous for their faith in the efficacy of the "patent," or more properly, the secret, medicine and the makers of patent medicines have always flooded the market with their nostrums, depending upon this credulity of the people for financial success. Aside from these articles of commerce, however, the staples of the drug trade, the legitimate drugs and medicines, were gathered from all quarters of the globe and widely distributed long before the discovery of America with its new drug sources became an important aid to the progress and development of the trade. Since the early days of the country's history, drugs, such as jalap, ipecac, sarsaparilla and balsams, have been imported from Mexico, as well as from Central and South America. As early as 1820, through the investigations of the French scientists, the separate alkaloids in cinchona bark were determined and Pelletier soon began their manufacture. It was at about the same time that John Farr started the first quinine factory in Philadelphia and the popularity of the drug was so immediate that John Currie soon followed by building a similar factory in New York.

In the early days the supplies of cinchona bark were imported through Spain, but the opening of the ports of South America to our commerce enabled us to secure the necessary shipments direct from those countries. In the beginning of the industry in America the Government placed an import duty upon foreign-made quinine, and as long as such duties remained in force, the American manufacturers had a practical monopoly of the home trade. In 1879, however, quinine was placed on the free list, and since that time the foreign makers who are able to produce the drug at a much lower cost than that at which we can make it, have not only shipped their surplus stock to this country, but have secured such a firm foothold that they now control nearly half of the American quinine market.

Stone-oil, or Seneca-oil, the substance which is now known as petroleum, was discovered in West Virginia, where it had long been popularly regarded as a most efficient liniment. It was found at several places in that State, where it rose to the surface of the ground, a heavy and dark substance, the true character of which was not recognized until many years later. In 1829, a similar supply was found in Cumberland County, Ky., and upon a well being drilled, a phenomenal quantity of oil was obtained. Owing to the fact that no ample provisions had been made to save the oil, the bulk of it was wasted. Some of it was preserved, however, and having been bottled, was sold in Europe under the name of "American Oil." The device on the label, a derrick, first suggested the means by which a sufficient quantity of the crude oil could be obtained to pay the cost of refining it, a process which resulted in the discovery of such valuable filtered paraffine residuums as petrolatum, vaseline, etc., preparations which have since become important articles of export

It is believed that the first historical mention of the manufacture of drugs in this country is that in the instructions given to Sir Francis Wyatt, governor of Virginia, in 1621. In this document he was requested to invite attention to the industrial possibilities to be found in the making of oil of walnuts, and he was authorized to employ such apothecaries as might be necessary to assure its proper production. The colonists were also requested to search for gums, dyes, and new drugs. In 1785, the South Carolina Agricultural Society offered special premiums for the cultivation of such drug plants as senna, cassia, hops, madder, rhubarb and figs. It is useless to attempt to describe the various articles known to the drug trade of that day, or to enumerate the uses to which they were put, but in even so brief a review as this, a word or two must be said about the old-time business conditions.

In the wholesale branch of the trade, some 75 years ago, the hours of business were from 7 o'clock in the morning until 9 o'clock at night. There were no railroads then, and means of communication between one part of the country and another were very primitive. After the Erie Canal was opened, the change in conditions brought about a corresponding change in business methods. Instead of dragging along through the year, the wholesale druggist had two busy seasons. There was a rush of trade in the spring, and another rush just prior to the close of navigation in the fall, and clerks, at these times in the year, were often required to remain at work until midnight.

The outbreak of the Civil War had an effect upon the drug trade just as it had upon every branch of business in the North. Many large outstanding accounts were canceled, and many houses, as the result, went out of business, although there were perhaps fewer failures in the wholesale drug line than in other branches of business.

To realize what a great variety of articles were included in the stock of the wholesale druggists of the olden times, it is only necessary to peruse some of the advertisements which such houses published some 100 years ago, while the extent of the purely drug stock may be pretty accurately approximated by a comparison of one of the early pharmacopœias with the current edition. The volume for 1830 is, perhaps, the best one to which we can refer to ascertain the condition of affairs which existed during the two or three decades prior to its issue. According to that authority there were 272 articles of materia medica, while 349 processes were given for preparations, making a total of but 621 titles. Sixty years later, the "United States Pharmacopœia" had no less than 994 titles, while the "National Formulary," a semi-official work of almost equal practical importance, had 435 more titles, making a total of 1,429 articles, or preparations, which the apothecary was able to furnish a customer upon demand.

Of course, the wholesale druggist of those days was compelled to carry many articles which were not strictly entitled to a place upon the pages of the pharmacopœias. In fact, this feature of the drug trade has so greatly extended that reference to recent price-lists issued by the prominent jobbing houses shows that there are now more than 5,700 articles in the department of drugs, chemicals, oils, etc., and close upon 8,000 articles in the department of "patent," or proprietary medicines. Moreover, if one should go so far as to include the almost incalculable number of articles which come under the head of "druggists' sundries," to say nothing of the "secret proprietary" medicines which, being confined largely to local trade, do not appear upon any general price-list, there is little doubt that the figures already given would be doubled; a fact which makes it safe to estimate that there are no less than 25,000 different articles handled by the drug trade of to-day.

So far as the retail druggist was concerned, his business at that period was largely a matter of "go as you please." If he could prepare, from the crude material, the prescriptions of the local physicians, he had succeeded in fulfilling the object of his existence. To-day, however, he enjoys most superior facilities, for while he is still required to be acquainted with all processes, he has the convenience of being able to purchase the greater portion of his stock ready for dispensing. To afford such facilities the business of manufacturing pharmacy has been developed, during the past fifty-odd years, into a distinct department of the drug trade.

Without laying undue stress upon the wonderful advances in inorganic chemistry, and especially in the remarkable work accomplished in the discovery and improvements of anæsthetics, there can be no question that the evolution of organic chemistry is one of the most stupendous scientific triumphs recorded since the middle of the 19th century. Wöhler's discovery, in 1828, that urea could be manufactured artificially from isocyanate of ammonium was really the first step taken toward the synthetic production of organic compounds, for, up to that period, it had been the undisputed theory of the scientists that no organic compound was possible except through the medium of "vital force." Wöhler opened the way to further experiments along such lines, however, and, since 1828, innumerable compounds of an organic nature have been prepared synthetically, many of which are of such great commercial importance that they are manufactured in extensive quantities. Among such compounds, for example, is alizarine, the chief coloring principle of madder root, of which fully $20,000,000 worth is produced annually from coal tar. Oxalic acid, which formerly came from the juice of the sorrel, is now artificially produced, at one-tenth its former cost, by the use of sawdust and caustic soda; while salicylic acid, which was formerly derived from the oil of wintergreen, is now produced more easily through the action of carbon dioxide upon carbolic acid and caustic soda. Not only has the chemist succeeded in producing many of the most important organic compounds in his own laboratory, however, but, during the past quarter of a century, he has discovered a vast number of new and interesting synthetic chemicals which have never been found in living plants and animals, among them, antipyrine, exalgine, phenacetine, etc. Moreover, as the number of these compounds which are of importance therapeutically is constantly increasing, such progress as is represented by these discoveries in allied science has exerted a powerful influence in elevating the drug trade to its present high position.

Of course, it must not be imagined that chemistry is the only agency that has been operative in shaping this development. One of the first in importance among these agencies has unquestionably been the "United States Pharmacopœia." The first pharmacopœia published in the United States was printed in Philadelphia in 1778. It was made up for military purposes. The next publication of the kind was issued by the Massachusetts Medical Society in 1808. But these did not have a considerable circulation, and, as a matter of fact, up to the beginning of the 19th century, and even for some years thereafter, drugs were dispensed according to the pharmacopœias of foreign countries; and it was not until some time be-

tween 1810 and 1820 that any attempt was made to better these conditions. In 1820, the first edition of the "United States Pharmacopœia" appeared, and this work, which has passed through successive decennial revisions up to this time, is regarded the world over as the standard in all manipulations of drugs and medicinal chemicals, from the identification of the crude material to the final stages in its preparation for the use of invalids. The names of Proctor, Maisch and Rice are inseparably connected with the early issues of this great work.

The governmental inspection of imported drugs, which commenced about 1825, was largely the result of the initiative taken by the newly-established pharmaceutical colleges in New York and Philadelphia. This inspection, still conducted by the national officials, has an important effect in upholding the standard of purity in drug imports.

The first law regulating the retail sale of drugs and poisons that was passed in the United States was enacted by the State legislature of Rhode Island, in 1870, but since that time almost every State in the Union has placed a similar act upon its statutes. While there is a lack of uniformity in these laws, in general they cover the same ground by restricting all dealings in drugs, as well as all compounding of prescriptions to such persons as have been able to pass a satisfactory examination before a board of pharmacy. As such laws were not retroactive their beneficial effect has been only partially determined, as those who were engaged in the drug business prior to the passage of these acts were allowed to continue regardless of their ability to pass an examination.

Another agency that has accomplished important results in the betterment of the drug trade are the various associations that have been founded since the middle of the 19th century. The first association instituted for the conservation and advancement of the material and professional interests of the business was the American Pharmaceutical Association, which was founded by 21 active pharmacists in 1852. This association holds annual meetings for the discussion of scientific and educational questions, and other matters relating to the welfare of the trade, has a membership of 2,490 (1916), and one of the effective features of its work is the annual publication of its proceedings, a work which presents a complete review of the scientific progress of pharmacy, and the monthly publication of *The American Pharmaceutical Association Journal.* One of the most important influences exerted over the retail trade is represented by the various State pharmaceutical associations, the oldest of which, that of New Jersey, was organized in 1870, while one of the most notable events in the history of the wholesale drug trade during the 19th century was the organization of the wholesale houses of the West under the name of the Western Wholesale Druggists' Association. It was founded in 1876, and was called into existence by the peculiar conditions of the times. In 1882, many of the prominent Eastern druggists joined forces with the Western wholesalers, at a meeting held at Cleveland, Ohio, and, at this time, the name of the organization was changed to the National Wholesale Druggists' Association. To secure trade, and, afterward, to hold it, required a competition that finally became so sharp that concerns which had hitherto been regarded as prosperous houses found themselves unable to make profits. As the result a committee was appointed to try to introduce a system that is now known as the "rebate plan." According to the old system such articles as patent medicines had been sold on a very close margin, and the new plan was devised to give the wholesale druggists an opportunity to obtain a fair profit upon such preparations. By the adoption of the "rebate plan," therefore, the wholesale druggists consented to sign a contract by which they agreed to maintain established prices, on condition that they were to receive 10 per cent reduction, or rebate, upon the regular wholesale price, and with the penalty of being placed upon the "cut-off" list, and thus debarred from buying from the proprietors, in case they were guilty of violating their agreement. At this time the only profit to the wholesale trade was this 10 per cent rebate. The plan worked well for a time, but was completely demoralized by the entry of the department stores into the drug business, and their policy of using cut prices on drugs and druggist's sundries to attract custom for other articles. The steps taken to correct this situation brought the trade up against the restrictions of the Sherman anti-trust law, and the government brought suit against the protective combination. The net result has been to reduce the margin in the wholesale drug business to a bare 3 per cent.

The retail drug trade of the present day has become almost altogether a mere distribution of the products of the great pharmaceutical and biological laboratories which are continually adding new remedies to their already extensive lists. The business of the largest manufacturing houses has become sixfold: the gathering of the crude drugs; the extraction of their active principles; the manufacture of synthetic drug preparations; the testing out for standardization; the commercial dispensing of their products; and the discovering of new drugs by specially commissioned explorers in the most remote regions of the earth.

Still another important factor in the growth and development of the drug trade is the American pharmaceutical press. Among the most prominent periodicals are such weekly papers as the *Pharmaceutical Era,* the *Shipping and Commercial List,* and the *Oil, Paint and Drug Reporter,* all of New York; semi-monthlies like the *American Druggist and Pharmaceutical Record,* of New York, and such monthly journals as the *American Journal of Pharmacy,* of Philadelphia; the *Druggists' Circular and Chemical Gazette,* of New York; *Pharmaceutische Rundschau,* of New York; the *Western Druggist,* of Chicago the *National Druggist,* of Saint Louis, and the *New England Druggist,* of Boston. Besides these there are some smaller periodicals of local influence, as well as a considerable number of publications issued by various colleges and societies, and by prominent drug firms and manufacturing houses.

There is, perhaps, no particular in which the development of the drug trade is indicated more clearly than in the improvements in its methods. Less than a century ago the apothecary was obliged to cut and roll his pills by hand, and

to make his plasters with a "spreading iron." He powdered his drugs in a stone or iron mortar, and made his tinctures in a wide-mouthed jar with the aid of a stirring stick. To-day such operations are performed by machinery, a process which has so simplified the work that the manufacturing pharmacist is now able, by the use of his power-machine, to turn out more than 100,000 pills a day, and plasters almost *ad libitum*. The power-machines which are used in the making of compressed tablets now made more than 500 tablets a minute.

The making of fluid extracts as a class of pharmaceutical preparations is essentially an American invention. They are made by percolation, or displacement, a process by which the powdered drug, placed in a suitable vessel, is deprived of its soluble constituents, by the descent of a solvent through it, an invention the importance of which cannot be overestimated, as much of the progress in American pharmacy during the last half of the 19th century was largely due to the study and development of the process of percolation, and the introduction of preparations which owed their existence directly to this invention. Percolation received the stamp of official recognition in the "Pharmacopœia" of 1840, and has occupied a place in all subsequent editions of that work. None of the editions of the "Pharmacopœia," prior to that of 1850, gave any formulas for the preparation of fluid extracts. In 1850, seven of these formulas were given and by 1890 the number had been increased to 88, although this number does not begin to represent the total manufacture of fluid extracts, which have now become almost as numerous and as popular as the vegetable drugs. Associated with the earliest manufacture of these extracts are the names of Henry Thayer of Boston, and Tilden & Co. of New Lebanon, N. Y.

Another innovation is the so-called "elixirs," which were originated some time in the later thirties. For a time this term was used almost exclusively by manufacturers to designate their aromatic, sweetened, spirituous preparations which contained comparatively small quantities of active medicinal substances, but no formula under that name was published for the use of druggists until 1859.

The first sugar-coated pills made in this country were manufactured by Bullock & Crenshaw of Philadelphia, and the Tilden Company, of New Lebanon, N. Y. The use of gelatine capsules as a means of administering nauseous remedies in a readily assimilable condition was also the direct result of American enterprise. This process was originally outlined by Mothes, of Paris, but the success in popularizing it was due to the efforts of H. Planten & Son, the firm which first made them in the United States. A firm which became very prominent in the earliest manufacture of gelatine coated pills was McKesson & Robbins.

It is difficult for us to-day to realize that it was not until after 1825, when the American surgeon, Beaumont, made his carefully conducted observations upon the phenomena of digestion in the living stomach, that the functions of the gastric juice were revealed. His investigations, which lasted until 1833, stimulated and suggested the course for subsequent researches, and, in 1836, when the active principle of the gastric juice was discovered by Schwann, he gave it the name of "pepsin." From a commercial point of view, the history of pepsin in America begins with the introduction of Scheffer's pepsin, in 1872. This preparation was made by a simple and practical method known as the "salt" process, and it was a great improvement over all of the older methods of obtaining the ferment from the stomach. A few years later, about 1879, the original form of pepsin in scales, "free from added substances or reagents," was introduced by Fairchild, and the advent of this preparation of phenomenal strength had the effect of causing great activity in the manufacture and improvement of the commercial pepsins. The practical recognition and application of pancreas ferments is due to the efforts of Fairchild, who, in 1880, introduced the *extractum pancreatis*, containing diastase for the conversion of starch, trypsin for the conversion of albumen, and emulsifying ferment for the digestion of fats, and the milk-curdling ferment, a preparation which proved to be of great utility, especially in the artificial digestion of foods for the sick, and in the preparation of foods for infants. Basing his theories upon the indigestibility of starch, Liebig proposed that the farinaceous foods which were commonly used with milk as food for infants should first be digested into soluble form by the use of malt diastase, while, in 1884, Fairchild proposed a method by which cows' milk might be modified and adjusted to a closer resemblance to human milk by the conversion of caseine, by the use of trypsin, to the soluble and peptone-like bodies for which the latter milk is peculiar.

The first improvement upon the antiquated method of applying plasters to the human body was the invention of an india-rubber porous plaster by Dr. Shecut, a naval surgeon. He sold his rights in the plaster to Thomas Allcock, and the latter, failing to make its manufacture profitable, sold it to Dr. Brandreth. At that time the only commercial plasters were made of isinglass and resinous mixtures, some of which were spread on cloth and plaster skins. It was about 1867 that Seabury & Porter began the experiments which finally resulted in the use of rubber in medicinal and surgical plasters.

It was in 1878 that Dr. R. M. Fuller, of New York, introduced another distinctively American form of medication under the name of "tablet triturates." These were made by a method in which the active ingredient was triturated, or ground, with either plain sugar of milk, or with a mixture of sugar of milk and cane-sugar, into a paste which was pressed into tablets in suitable molds. By this process it was possible to administer small quantities of such potent remedies as alkaloids, concentrations, etc., in a convenient, palatable, and readily soluble form. Unique as the idea was, it immediately became so popular with the medical profession that the manufacturers began to produce them upon an enormous scale, one manufacturer alone having no less than 500 different varieties of these tablets on his price-list.

Great as have been the developments along individual lines, however, it is only by reference to statistics that we can gain any idea of the magnitude of the commerce to which the modern drug trade has attained. The United States

government kept no record of the imports and exports in drugs until 1830, and even then the list was confined to a few items. In 1830, the exports from the United States were stated to be $130,238, while in 1835 they were reported as being about $200,000. In 1916 the exports of patent medicines alone amounted to a value of $8,397,971, and of roots, barks and herbs, a value of $768,977. These figures by no means show the total value of medicinal preparations sold abroad. The government reports include such commodities with «chemicals» in such a way that they cannot be separated. The imports may be traced somewhat closer, and, omitting the inorganic and mineral substances used both in medicine and the arts, the government figures for the fiscal year ended 30 June 1916, show an importation of crude drugs and drug plants of 69,379,724 pounds, valued at $6,914,658. In addition, antitoxins, serums and vaccines valued at $8,225 were imported. It should be noted in passing that previous to the European War the larger part of the drug supply of the world passed through the ports of London, Hamburg, and Trieste. The closing of the two latter ports almost completely demoralized the trade. In the United States prices speedily advanced as stocks diminished, and in some cases reached figures 1,000 per cent above the ante-war prices. Movements to grow drug plants in the United States have been discouraged on the ground that the different climatic conditions would affect unfavorably the effective drug content, and that with the end of the war prices will fall below a remunerative point. Nevertheless the experiment is being made in several sections of the country.

Unfortunately there are no data from which we may estimate the number of druggists doing business in the United States at the beginning of the 19th century. The New York directory for 1786 mentions the names of only five. One druggist, Effingham Lawrence, was official apothecary to the Medical Society, a committee from which visited his store once every three months to certify that his drugs were genuine and his medicines properly prepared. Among the wholesale drug houses now in business in New York, one, founded more than a century ago, by Jacob Schiefflin, in 1794, is still under the control of his descendants. The firm of Powers & Weightman, of Philadelphia, began business under the name of Farr & Kunzi, in 1818, while the first drug store in Washington was opened by Frederick Miller in 1796. The oldest drug house in the West is probably that of T. H. Hinchman & Sons, of Detroit, Mich. The earliest wholesale druggists in Chicago were Dr. Clark, Dr. Brinkenhoff — now Peter Van Schaack & Sons — and Dr. John Sears, while among the other wholesale houses doing business in New York three-quarters of a century ago one may mention the firms of Lawrence & Keese, J. A. & W. B. Post, Thomas S. Clark, John & William Penfold, John M. Bradhurst, R. & S. Murray, Silas Carle, Olcott & McKesson, now represented by two firms, Dodge & Olcott and McKesson & Robbins, and John C. Morrison. Among the manufacturers of medicinal chemicals the following firms are worthy of mention: Rosengarten & Son, of Philadelphia; Charles Cooper & Company, of New York; Charles Pfizer & Company, of New York; Mallinckrodt Chemical Works, of Saint Louis; Larkin & Scheffer, of Saint Louis; Herf & Frerichs Chemical Company, of Saint Louis, and the New York Quinine and Chemical Works.

In 1850 Haskell & Merrick put upon the market a select line of drugs, including morphine, chloroform, ether, galenical extracts, opodeldoc, mercurial and some other salts. At that time Philadelphia was the centre of trade for English chemicals, Boston for East India drugs, and New York for Spanish, French, German and Italian drugs and preparations. In the decade following many fluid extracts and some glycerine extracts were added to the list of ready made supplies. One of the pioneers in the manufacture of pharmaceutical preparations was Dr. E. R. Squibb, a past assistant surgeon in the United States Navy, who organized and ran the United States Naval Laboratory from 1854 until 1858. The enormous demand caused by the Civil War was the incentive for the establishment of his remarkable laboratory. Among the other pioneer manufacturers are the Tilden Company, of New Lebanon, N. Y.; Billings, Clapp & Company, and the E. L. Patch Company, of Boston; Sharp & Dohme, and the Burroughs Brothers Manufacturing Company, of Baltimore; Henry Thayer & Company, of Cambridgeport, Mass.; William R. Warner & Company, John Wyeth & Brother, and the H. K. Mulford Company, of Philadelphia; Parke, Davis & Company, and Frederick Stearns & Company, of Detroit, Mich.; the William S. Merrill Chemical Company, of Cincinnati; Eli Lilly & Company, of Indianapolis, and Charles S. Baker & Company, and the Searle & Hereth Company, of Chicago. The pioneer manufacturer of druggists' balances, or fine scales, was Henry Troemner, who came to this country from Marburg, Germany, in 1836, and, two years later, started business in Philadelphia. Prior to this time the scales which were required by druggists had been made to order by jewelers.

The present volume of the drug trade in the United States can only be approximately estimated, as the data are inextricably tangled with those of the chemical industry (q.v.). The most accurate survey to be made is with the aid of the figures recorded by the United States Census of Manufactures for 1914, which gathered separate statistics relating to the manufacture of «druggists' preparations,» «patent and proprietary medicines,» and «perfumery and cosmetics.» Reports were received from 4,082 establishments whose combined products were valued at $172,008,946. Of the total number, 850 were located in New York, 391 in Illinois, 353 in Pennsylvania, 267 in Ohio, 234 in Missouri, 179 in Massachusetts, 155 in Michigan, 142 in California, 134 in New Jersey, 107 in Minnesota, and the remaining 1,109 scattered among 34 other States.

The manufacture of druggists' preparations was reported by 438 establishments with products valued at $48,624,966. Liquid preparations, such as tinctures, fluid extracts, and medicinal syrups, were valued at $13,900,402; and of pills, tablets, powders, etc. at $10,903,056. The manufacture of alkaloids and their derivatives, such as cocaine, codein, morphine, quinine and strychnine, was reported by 142 establishments, with products valued at $11,493,168. The production

of synthetic medicinal preparations, such as acetanilid, saccharin, methylsalicylate, etc., was reported by 72 establishments, with an output valued at $1,384,996. Medicinal metals and their salts, bromides, citrates, bismuth, etc., were produced at 47 establishments, their output being valued at $732,307. Serums, vaccines, toxins, and other biological products were prepared at 93 establishments, their output being valued at $6,223,475.

The manufacture of patent and proprietary medicines and compounds, including household ammonia, insecticides, fire extinguisher compounds, etc., was reported by 3,085 establishments, with products valued at $105,665,611. These figures show an increase in the number of establishments since 1909 of 8.7 per cent, and an increase in the value of products by 26.1 per cent. The larger part of this business was carried on in New York State by 617 establishments — as compared with 300 in Illinois, 275 in Pennsylvania, 209 in Missouri, and 156 in Ohio.

Perfumery and cosmetics, including cologne and toilet waters, face powders, cold cream, etc., were made by 559 establishments, their output being valued at $17,718,369. These figures show a large increase in both the number of establishments engaged and the value of the products, amounting to 30.3 per cent in the first instance and 24.7 per cent in the second. New York claimed the largest share in this industry with 175 establishments, followed by Illinois with 67, Pennsylvania with 45, and Ohio with 34.

The enormous increase in the consumption of medicines in the United States is indicated by the fact that while the population of the country from 1880 to 1910 increased 83.3 per cent, the value of the patent medicine manufactured in the same period increased 740.5 per cent. Practically the whole of this production passes through the medium of the drug trade. These figures, however, represent but a small part of the actual consumption of medicines by the American people at the present day. As but one instance available of the dissemination of drugs outside of the patent medicine class, it may be mentioned that in the fiscal year ended 30 June 1916, an amount of quinine was imported into the United States sufficient to make 2,200,000,000 average doses — an equivalent of 22 doses for every man, woman and child in the population. The importation of opium and its alkaloids amounted to the equivalent of 1,200,000,000 average doses of morphine. It is worthy of note that in the case of morphine the importations are less than one-third of their normal volume before the war. A much larger effect is shown in the importations of "medicinal preparations" which in the year quoted amounted to a value of but $181,643, while in 1913 their value was $1,621,520.

One of the interesting features of the American drug trade has been the introduction of the Chinese drug store, with the identical drugs carried in stock in the Orient. A few of these are very closely allied to the drugs of the American store, and with practically the same medicinal value. Most of the "remedies," however, are the grotesque collection of triturated deer horns, ginseng roots, curiously sculptured gourd seeds, and magical charms of various kinds and alleged potencies.

DRUGGET, a coarse and flimsy texture originally half silk and half wool, chiefly used for covering carpets. It was formerly extensively employed as an article of clothing by the poorer classes, more especially of females; but this and similar fabrics are now almost wholly superseded by cotton goods, which induce greater cleanliness.

DRUID, a member of the Celtic priesthood of ancient Britain and Gaul, which at the period of the Roman invasion existed chiefly in Brittany and along the valley of the Loire, and in the island of Anglesey, in Wales and in Ireland. Scattered throughout these regions, at Carnac in Brittany, at Stonehenge and Avebury in England and numerous other localities, are the stupendous stone structures, known as cromlechs, menhirs, dolmens, kistvæns, etc., ascribed by the older archæologists to the druidical cult, and still popularly known as druidical temples and altars, but now assigned by scientists to prehistoric palæolithic and neolithic predecessors, although it is probable these megalithic monuments were used by the Druids in their mystic rites to impress the populace. Welsh tradition relates that the Druids entered Gaul from the Orient with the Celtic Kymric race, and their religious practices have been variously described as of Hindu, Persian and Egyptian origin. Accurate knowledge of the sect is limited owing to their inviolable practice of not allowing their history to be written, all their lore being committed to memory, and all instructions being imparted orally. The best ancient and contemporary account of the Druids is that by Julius Cæsar, who thus describes them: "They attend to divine worship, perform public and private sacrifices and expound matters of religion. A great number of youths are gathered round them for the sake of education and they enjoy the highest honor in that nation, for nearly all public and private quarrels come under their jurisdiction, and when any crime has been committed, when a murder has been perpetrated, when a controversy arises about a legacy or about landmarks, they are the judges, too. They fix rewards and punishments; and should any one, whether a private individual or a public man, disobey their decrees, then they exclude him from the sacrifices. This is with them the severest punishment. The persons who are thus laid under interdict are regarded as impious and wicked people; everybody recoils from them and shuns their society and conversation, lest he should be injured by associating with them. They cannot obtain legal redress when they ask for it, nor are they admitted to any honorable office. All these Druids have one chief, who enjoys the highest authority among them. When he dies, he is succeeded by the member of the order who is most prominent among the others, if there be any such single individual; if, however, there are several men equally distinguished, the successor is elected by the Druids. Sometimes they even go to war about this supremacy. At a certain time of the year the Druids assemble on the territory of the Carnutes, which is believed to be the centre of all Gaul, in a sacred place. To that spot are gathered from everywhere all persons that have quarrels, and they abide by their judgments and decrees. It is believed that this institution was

founded in Britannia and thence transplanted into Gaul. Even nowadays, those who wish to become more intimately acquainted with the institution generally go to Britannia for instruction's sake.

«The Druids take no part in warfare; nor do they pay taxes like the rest of the people; they are exempt from military service and from all public burdens. Attracted by such rewards, many come to be instructed by their own choice, while others are sent by their parents. They are reported to learn in the school a great number of verses, so that some remain there 20 years. They think it is an unhallowed thing to commit their lore to writing, though in the other public and private affairs of life they frequently make use of the Greek alphabet. . . . Beyond all things, they are desirous to inspire a belief that men's souls do not perish but transmigrate after death from one individual to another; and they hold that people are thereby most strongly urged to bravery, as the fear of death is thus destroyed.»

Besides being priests and teachers of religion the Druids appear also to have been adept astrologers and magicians, and were versed in the mysterious powers of animals and plants; the oak-tree, the mistletoe when growing on the oak, the vervain, the hyssop and marshwort were held in especial reverence among them, and like the Romans, they drew auguries and prophecies from an inspection of the entrails of sacrificed animals and from the flight of birds; their mysterious rites were usually performed in the depths of oak forests. The order was divided into three classes: vates or prophets, bards and priests; with them were associated, but without sharing their prerogatives, three classes of prophetesses or sorceresses.

Before the advent of the Romans the autocratic powers of the priesthood aroused the antagonism of the warrior element of the tribes, and according to Cæsar, the latter had deprived them of much of their political power. The Druids exerted all their powers to oppose the Roman conquerors and continually incited the people to rebellion, until they were driven out of Brittany into Wales, and finally gathered in the island of Anglesey, where they were attacked by Suetonious Paulinus in 61 A.D., and in 78 A.D. were utterly subdued and almost exterminated by Agricola. (See DRUIDS). Consult Rhys, 'Lectures on the Origin and Growth of Religion as Illustrated by Celtic Heathendom' (London 1888).

DRUID STONES, a name given in England and other parts of the country to weather-worn, rough pillars of gray sandstone which are scattered over the surface of the chalk-downs in England, in Scotland and its islands, and which exist in great numbers in other countries; generally in the form of circles or in detached pillars; it is not certain, however, that the Druids had any connection with these stones.

DRUIDS, The United Ancient Order of. This fraternal and benevolent society takes its name and nomenclature from the history of the Druids of Gaul and Britain. They were the religious guides of the people and the chief guardians and expounders of the law. They taught the immortality of the soul. Their chosen retreats were groves of oaks, and the remains of their temples are circular cromlechs and dolmens of immense stones. They attained their greatest influence in Britain shortly before the Roman invasion, during the last century B.C. They were believed to have incited the patriotic revolt of the Britons against Roman rule; and Agricola, when governor of Britain, cut down their sacred groves and destroyed their temples, when the Druids who escaped fled to the island of Iona. Upon the conversion of the Britons to Christianity, Druidism became only a venerable memory and tradition. Its nomenclature and traditions form the picturesque background of the ceremonies of the modern order of fraternity and benevolence. The modern order was formed in England in 1781 and its centennial was celebrated in America by enthusiastic meetings and addresses in a number of cities. It was introduced into the United States about 1830, but the earliest society died out. A permanent beginning, however, was made in George Washington Lodge, No. 1, instituted in New York in 1839. The order has reached now a membership in the United States of 30,968; in England, Australasia and Germany, 302,247; total membership, 333,215. The order has paid since its introduction in the United States in sick benefit and other relief the sum of $7,141,772.53. The relief granted during the fiscal year 1915 was $103,-776.53. In the nomenclature of the order the name Grove is used commonly as the name lodge in other orders. The higher body in a State is called a Grand Grove and different Grand Groves are under the Supreme Grove, which is the head of the Order, with full power to make laws for its own government and for the government of its State, Grand and Subordinate Groves. The Order is in union with the Order in England, Australia and Germany. The Order is a moral, social and beneficial society. Its principles and teachings are derived from Ancient Druidism and are founded on reason and sound morality. They do not conflict with any of the established systems of religion and are perfectly compatible with the peace and welfare of the State. No oaths are administered by the Order binding its members to any creed or faction; in becoming Druids they are still free men. Its so-called secrecy is not a cloak for evil but simply a protection against abuse of its beneficial provisions. Its objects are: to unite men together, irrespective of nation, tongue or creed, for mutual protection and improvement; to assist socially and materially by timely counsel and instructive lessons; by encouragement in business and assistance to obtain employment for those in need; and to foster among its members the spirit of fraternity and good fellowship. Its well-regulated system of dues and benefits provides for the relief of the sick and destitute, the burial of the dead and the protection of the widows and orphans of deceased members. Members of subordinate Groves must be males of 18 years and upwards, of sound health and character, and are elected on the proposal of members. To promote the prosperity of the Order and cultivate the perfection of its members, Druidic Chapters have been organized. All members in good standing, who have attained the third degree, are eligible. In order

to provide women an opportunity to participate in the benevolent work, Circles have been established, to which Druids in good standing and all acceptable women 18 years of age are eligible.

DRUILLETTES, drwē'yĕt, **Gabriel,** Jesuit missionary: b. France 1610; d. Quebec 1681. He entered the order in 1629 and was sent to Canada in 1643. In 1646 he was sent on a mission to the Abenakis and was the first white man to make the overland journey from Quebec to the seaboard of Maine. In 1650 he was sent by the French authorities on a trade reciprocity and mutual defense mission to the United Colonies of New England and was cordially received at Boston. He returned in the following year with definite proposals for a treaty, which, however, were formally declined. On going back to Canada he resumed his missionary work and in 1671 was in charge of the mission at Sault Sainte Marie.

DRUM, a musical instrument formed by stretching parchment animal skin over the heads of a cylinder of wood or over a bowl-shaped metallic vessel. There are three kinds of drums: (1) The long drum or bass drum with two heads, held laterally and played on both ends with stuffed-knob drumsticks. This is the ordinary drum used by an infantry or marching band. It is employed mainly to mark the time and also to increase the fortes. The big drum, or *grosse caisse*, of the modern orchestra, is a modification of the ordinary drum, with the diameter greatly increased and the length of the cylinder lessened. It is struck on one side only. (2) The side-drum, having two heads, the upper one only being played on by two sticks of wood; the lower head has occasionally strings of catgut stretched across its surface, and then it is called a snare drum. It is the side-drum of the fife and drum bands. It is occasionally employed in the orchestra for special effects. (3) These are either the small kettle-drums of the cavalry band, played on horseback, or the proper orchestral drums, larger in size but similar in construction. They are generally tuned to the tonic and dominant of the composition in which they are used, but this rule is not without exceptions. The tambourine is a species of drum, consisting of a single skin on a frame or vessel open at bottom. The heads are tightened by cords and braces or by rods and screws.

The drum was a martial instrument among the ancient Egyptians, as the sculptures of Thebes testify. Their long drum was like the Indian tam-tam and was beaten by the hand. It was about 18 inches long, had a case of wood or metal and heads of prepared skin, resembling parchment. These were braced by cords in a manner somewhat similar to the modern. The instrument was carried by a belt and was slung behind the back on a march. The invention of the drum is ascribed to Bacchus, who, according to Polygœnus, gave his signal of battle by cymbal and drum. It was, however, known in very early ages and in some form or other among almost all nations.

DRUM, a Celtic word common in Ireland and Scotland, signifying a knoll, ridge or small hill, frequently found alone as the name of a village, farm, estate, etc., and often also as a prefix, as in Drumalbin, Drumderg, Drumlanrig, Drummossie, etc. Irish geologists give the name to all elevations.

DRUMCLOG, Scotland, a place in Lanarkshire, on the borders of Ayrshire, 16 miles southeast of Glasgow. In 1675 Drumclog was the scene of a battle in which the Covenanters defeated the Royalists. The battle is described in Scott's 'Old Mortality.' A monument marks the scene of the encounter.

DRUMFISH, or **DRUM,** certain fishes of the family *Sciænidæ* (q.v.), so-called from the resonant sound which they produce in the water by forcing gas through the air bladder. In the United States the name is especially applied to the following. The common drumfish (*Pogonias chromis*) which has a short stout body, numerous barbels on the lower jaw, and large pavement-like teeth on the pharyngeal bones. It is one of the largest of food fishes, though the flesh is not highly valued. The drumfish is common on sandy shores south of Long Island and is caught on lines thrown into the surf. By means of its powerful dentition the shells of the stoutest mollusks and crustaceans are crushed and their contents devoured. At times schools of drumfish create great havoc on oyster beds. The red drum or red-fish (*Sciænops ocellata*) is a small fish, weighing from 10 to 75 pounds, and distinguished by the separate lower pharyngeal bones, the absence of mandibular barbels, and the eye-like spot at the base of the tail. It is one of the most important game and food fishes of the southern United States, especially in Texas. The black drum (*Sciæna deliciosa*) is a closely allied dusky bluish species found in the warmer parts of the Pacific coasts of America. The fresh-water drum or sheepshead (*Aplodinotus grunniens*) is closely related to the common marine drumfish, from which it differs in the absence of barbels. It ranges from the Great Lakes, where its flesh is coarse and rank and of little value for food, to Texas, where it becomes a fine-flavored and important food fish. It sometimes exceeds 50 pounds in weight.

DRUMLIN, a smoothly rounded oval hill of unstratified boulder clay, or till, formed beneath the great ice sheets of the glacial period. Drumlins are most frequently found near what was the front of the ice sheet, and, by their peculiar form, are easily recognized. They are usually over half a mile long and from 100 to 200 feet high and occur with their longer axes parallel to the direction of ice movement. Drumlins are of common occurrence in Massachusetts, particularly about Boston harbor, where some form islands. They are also abundant in western New York and in southern Wisconsin. Their method of formation is uncertain, though they plainly represent material gathered beneath the ice sheet and in some way piled up by it. See DRIFT; GLACIAL PERIOD.

DRUMMOND, SIR George Gordon, English soldier: b. 1772; d. London, 10 Oct. 1854. He entered the British army as ensign in 1789; became lieutenant-colonel of the king's Liverpool regiment in 1794. In 1795–96 he served in the West Indies and in the Egyptian campaign. In 1805 he became major-general and was appointed in command of a division in Jamaica, which post he held for several years. He was on duty in Canada 1808–11, and

promoted lieutenant-general 1811. He was again ordered to Canada as second in command under Sir George Prevost 1813; planned and effected the capture of Fort Niagara; planned the successful attack on Black Rock and Buffalo; led a combined military and naval force against Oswego and destroyed the American works and stores, May 1814. He was in command of the British forces at the battle of Lundy's Lane 25 July, and in August invested, but failed to capture, Fort Erie. After being promoted general in 1825, he was again transferred to the colonelcy of his old regiment.

DRUMMOND, Henry, Scottish geologist and religious writer: b. near Stirling, 17 Aug. 1851; d. Tunbridge Wells, 11 March 1897. He was educated at the universities of Edinburgh and Tübingen; entered the ministry of the Free Church, and having devoted much attention to science, was in 1877 appointed lecturer on natural science in the Free Church College, Glasgow, being made professor of theology in 1884. One of his most popular books was 'Tropical Africa' (1888), giving his own experiences in that part of the world. His most remarkable work, and the one by which his name became most widely known, is 'Natural Law in the Spiritual World' (1883), which has passed through many editions and been translated into various languages. This work was written with the object of showing that such scientific doctrines and theories as those associated with the name of Darwin and his followers were not incompatible with revealed religion. He was author also of 'Travel Sketches in Our New Protectorate' (1890); 'Pax Vobiscum' (1890); 'The Programme of Christianity' (1892); 'The Greatest Thing in the World'; 'The Ascent of Man' (1894). The last-named work is a semi-popular review of evolution theories which caused some controversy on its first appearance, mainly on account of its author's insistence on the recognition of altruism, or "the struggle for the life of others," as the most important factor in organic and especially in social evolution. His facile and fervid style of composition suited the tastes of large numbers of readers. Consult 'Life' by G. A. Smith (1898).

DRUMMOND, James, English Unitarian theologian: b. Dublin, Ireland, 14 May 1835. He was educated at Trinity College, Dublin, entered the Unitarian ministry and became professor of theology at Manchester New College in 1869, succeeding Rev. James Martineau (q.v.) as its principal in 1885. He removed with the college to Oxford in 1889, and retired in 1906. He has published 'Spiritual Religion: Sermons' (1870); 'The Jewish Messiah' (1877); 'Introduction to the Study of Theology' (1884); 'Philo-Judæus: or the Jewish-Alexandrian Philosophy' (1888); 'Via, Veritas, Vita' (1894); 'The Pauline Benediction' (1897); 'International Hand-books to the New Testament' (ed. by Orello Cone); 'The Epistles of Paul the Apostle to the Thessalonians' (1899); 'Life and Letters of Dr. Martineau' (with Upton 1902); 'The Character and Authorship of the Fourth Gospel' (1904); 'Studies in Christian Doctrine' (1908); 'Johannine Thoughts' (1909); 'Lectures on the Composition and Delivery of Sermons' (1910); 'Paul: his Life and Teaching' (1911).

DRUMMOND, James, Australian journalist and author: b. New Zealand, 17 Oct. 1869. He was employed as a printer in the government office at Wellington; but he soon turned to journalism and has held important positions on the leading newspapers of New Zealand. He has written extensively on colonial history, natural history, and especially on ornithology. Among his published works are 'Nature in New Zealand' (1902); 'The Animals of New Zealand' (1905); in collaboration with F. W. Hutton, 'Life and Work of Richard John Sheldon' (1906); 'Our Feathered Immigrants' (1907); 'John Rutherford' (1908); 'Life of Samuel Marsden' (1914); and extensive contributions to English and colonial magazines and newspapers.

DRUMMOND, Thomas, Scottish inventor: b. Edinburgh, October 1797; d. Dublin, 15 April 1840. He went to Woolwich to receive special instruction in the duties of an engineer, and while pursuing his studies showed his inventive talent by devising a form of pontoon which recommended itself by its facility of transport as well as by its admirable adaptation to the immediate purpose for which it was intended. Having heard the incandescence of lime mentioned in a lecture, it struck him that the light produced by this incandescence might be advantageously applied to replace the Argand-lamps which were used in the surveys, and after devoting a good deal of attention to the subject, he found a means of effecting the desired object. (See CALCIUM LIGHT). On the first occasion on which the light was employed, in the Irish survey, it showed the position of a station 66 miles distant. While on the same survey he invented a heliostat which has always been employed since in land-surveying, and with the aid of which observations can be taken at distances exceeding 100 miles. In 1835 he was appointed Under-secretary for Ireland, and in 1836 was chairman of a commission on railways in Ireland, and gave a very valuable report of the proceedings of the commission. His services to Ireland were recognized by the erection of a statue by public subscription.

DRUMMOND, William, of Hawthornden, Scottish poet: b. Hawthornden House, near Edinburgh, 13 Dec. 1585; d. there, 4 Dec. 1649. He was graduated at the University of Edinburgh in 1605, afterward studying at London, Bourges and Paris. He retired to Hawthornden, "a sweet and solitary seat, and very fit and proper for the muses," and gave himself up to the cultivation of poetry and polite literature. A dangerous illness fostered a serious and devout turn of mind, which was evinced by his first productions, 'The Cypress Grove,' in prose, containing reflections upon death; and 'Flowers of Sion, or Spiritual Poems.' He was a friend of Drayton and of Montrose, and entertained Ben Jonson at Hawthornden for three weeks on the occasion of a visit which the English dramatist made to Scotland in the winter of 1618–19. To this visit a great deal of interest is attached from the fact that Drummond took notes of the conversations held with Ben Jonson, which were afterward published, though not till long after the death of both. They first appeared in the folio edition of Drummond's works in 1711. These notes were republished separately by the Shakespeare Society in 1842.

As a historian, Drummond is chiefly remarkable for an ornate style, and a strong attachment to the High Church principles of the Jacobites. His 'History of the Reigns of the Five Jameses' was published several years after his death. An ardent Royalist, he was forced to sign the Covenant, and it is said that the news of the execution of Charles I hastened his death. He is now remembered only as a poet. Although tinged with the conceits of the Italian school, there is much genuine imagery and truth of feeling in all his poetry, but particularly in his sonnets, which are replete with tenderness and delicacy. He wrote in English, and not in his native Scots. See his 'Poems,' edited with memoir, by Ward (1894); 'Life,' by Masson (1873).

DRUMMOND, William Henry, Canadian poet: b. County Leitrim, Ireland, 13 April 1854; d. 6 April 1907. In early life he came to Canada; was educated at McGill University, Montreal, and in 1884 was graduated in medicine at Bishop's College, Lennoxville, province of Quebec. Here for some time he taught medical jurisprudence. He established his practice in a mixed community of Indians, French-Canadians, Scotch-Irish and English, which to his unusual powers of observation offered a splendid field for character study. He is especially successful in portraying the French *habitant* of the forest and lumber camp. His works include 'The Habitant and other French-Canadian Poems' (1897); 'Phil-o-rum's Canoe and Madeleine Vercheres' (1898); 'Johnnie Courteau and Other Poems' (1901); 'The Voyageur and Other Poems' (1905); 'The Great Fight' (1908). In 1912 appeared 'The Poetical Works of William Henry Drummond,' with an introduction by Louis Fréchette and an appreciation by Neil Munro. Consult "English-Canadian Literature," on 'Canada and its Provinces' (Vol VI, Toronto 1914).

DRUMMOND ISLAND, the extreme west of the Manitoulin chain, in Lake Huron, belongs to Chippewa County, Mich. It measures 20 by 10 miles.

DRUMMOND LIGHT. See DRUMMOND, HENRY; CALCIUM LIGHT.

DRUMONT, drů'mon', **Edouard Adolphe,** French journalist: b. Paris, 3 May 1844. He entered the government service, which he later abandoned to become a contributor to the press. He published several works, many of which were violently anti-Semitic in character. His 'Mon vieux Paris' (1879) was crowned by the academy. In 1892 he founded *La Libre Parole* as an organ for his views. In 1898–1902 he sat for Algiers in the Chamber of Deputies. His works include 'La France juive devant l'opinion' (1886); 'La fin d'un monde' (1888); 'Dernière bataille' (1890); 'Testament d'un antisémite' (1891); 'Secret de fourmies' (1892); 'De l'or de la boue du sang' (1896), dealing with the Panama Canal exposé; 'Les Juifs et l'affaire Dreyfus' (1899); 'Vieux portraits, vieux cadres' (1900). Consult Arnoulin, Stéphane, 'M. Edouard Drumont et les Jésuites' (Paris 1902).

DRUNKENNESS, the mental and physical condition resulting from excessive drinking of intoxicating liquors. In law, it is not considered an absolute defense, although in some cases, depending on the nature of the act, and to what extent the person was under the influence of intoxicating drinks, the offense, when committed by a drunken man, is changed to one of less severity. The general rule is, that if a person voluntarily, by the use of intoxicating liquors, deprives himself of his reason, he cannot offer it as a defense for acts which he commits while intoxicated. If the intoxication is carried to such an extent as to be a disease, such as delirium tremens, or *mania a potu,* a different question is raised, and, in the first case, it will reduce the offense and in the second case there are some decisions which go so far as to hold that it is a complete defense.

The general rule is that contracts made by a person under the influence of liquor are voidable and not void; so that if a person while intoxicated makes a contract under which some innocent third person, for value, acquires rights, the contract is binding on the person making it, although he was under the influence of liquor at that time. If a person makes a contract when so far under the influence of liquor as to be deprived of his senses, and the contract is so one-sided as to be unreasonable, the question of fraud may enter into the transaction. In cases where a person is tried for murder in the first degree, to prove that crime the evidence must show, according to the statute defining murder in the first degree, malice aforethought. Now it has been held that an excessive intoxication excludes the malice and only passion is shown and the crime is reduced below murder in the first degree. But the person accused must prove intoxication to such an extent that passion and not malice will be shown. Although if a person, while sober, makes all preparation to take a person's life, and then, before committing the crime, becomes intoxicated, doing an act when intoxicated which he was afraid to do when sober, it would be murder in the first degree. In cases of robbery, it is presumed the goods are taken with a felonious intent, but if the accused can prove sufficient intoxication, the felonious taking is not presumed. When a person is tried for an act and the defense is provocation, the amount of provocation to make a good defense would be less when the person who gave the provocation was intoxicated than if he was sober and in his right senses. In itself drunkenness is not a legal offense, though drunken conduct in public may be a nuisance and as such is often made a statutory offense, punishable by fine or imprisonment. Habitual drunkenness may also render a drunkard liable to a judicial inquisition for the appointment of a guardian of him and his property. Such a proceeding is properly instituted by wife or children or next of kin on the ground of his incompetency to look after his property or manage his business affairs. (See ALCOHOLISM; DIPSOMANIA; INTOXICATION; TEMPERANCE). Consult Bishop, 'Commentaries on Non-Contract Law' (Boston 1889); Kent, 'Commentaries on American Law'; Pollock, 'Principles of Contract in Law and in Equity' (2d Amer. ed. by G. H. Wald, Cincinnati 1885); Woodruff, 'Cases on Domestic Relations and the Law of Persons' (New York 1897).

DRUPE, in botany, a simple, succulent stone-fruit composed of a single monospermous carpel, of which the carpellary leaf becomes

fleshy at its external division, and ligneous in its internal division, as in the peach, cherry, plum, olive, etc. The stone which encloses the kernel is the endocarp; the pulpy, or succulent part, the mesocarp. In the horse-chestnut and cocoanut, the mesocarp is not succulent, and in the date the endocarp is replaced by a membrane.

DRURY, Alfred, English sculptor: b. London. His art education was obtained at the National Art Training School, South Kensington, and in Paris under Dalou. His principal works are 'The Triumph of Silenus' (1885); 'Circe' (1893); 'St. Agnes' (1894); 'The Age of Innocence' (1897); 'Prophetess of Fate'; 'Little Duchess' (1900); 'Innocence' (1902); 'King Edward VII' (1903).

DRURY, Dru, English silversmith and entomologist: b. 4 Feb. 1725; d. 15 Dec. 1803. He was devoted to the study of entomology and to collecting exotic insects and published 'Illustrations of Natural History' (1770–82), with upwards of 240 figures of exotic insects. His 'Illustrations of Exotic Entomology' was edited in 1837 by Westwood and appeared with nearly 700 figures by Moses Harris.

DRURY COLLEGE, a coeducational institution in Springfield, Mo.; founded in 1873 under the auspices of the Congregational Church. In 1916 the college had 30 professors and instructors and 350 students. The library contained about 32,000 volumes.

DRURY LANE THEATRE, a famous place of amusement in London, located in Russell Street, near Drury Lane. It was first opened in 1663, and was rebuilt by Sir Christopher Wren and reopened in 1674. It was again rebuilt in 1794. The present edifice was opened in 1812, with a prologue by Lord Byron, the advertisement for which gave rise to the famous 'Rejected Addresses.' Garrick opened the theatre in 1747 with Dr. Johnson's prologue; and most of the great English actors have trod the boards which are now given over for the most part to pantomimes and spectacular pieces.

DRUSE, a surface covered with projecting crystals. Also a cavity lined with small crystals, in the latter sense a geode. The adjective drusy means covered with small crystals.

DRUSES, a people of Syria, scattered over an extensive tract of country lying to the southeast of Beirut, and south of the country occupied by the Maronites; or, more particularly, they occupy the southern parts of Lebanon and Anti-Lebanon (the slopes of Hermon), while considerable numbers also inhabit the Hauran (south of Damascus), where the mountainous tract occupied by them is now often designated the Druse Mountain. The total Druse population is estimated at from 100,000 to 150,000. In the northern districts occupied by them they are mingled with the Maronites, but many towns and villages are peopled almost exclusively by the Druses. There are some circumstances which tend to show that the Druses are not indigenous to the territory they now possess, although they have long since dropped their own language and adopted the Arabic. They were in Lebanon and Anti-Lebanon as early as the 11th century. The peculiar interest attaching to this people belongs, however, more to their political constitution and their religion than to their origin. Politically the Druses are divided into two parties, that called the Jumblatiehs, with the family of Jumblat at their head; and the Yezbekiehs, with that of Abou-Nakod at their head. These two parties live in almost constant strife, except when they have a common foe to contend against, when they forget their internal dissensions and unite their strength for offense and defense. Their religion is a curious mixture of Judaism, Christianity and Mohammedanism. They believe in one God, who is the only being to whom worship ought to be paid. According to their religious books he cannot be defined by any of the qualities belonging to created beings. The doctrine of the unity of the Deity does not admit, in their view, even of the consideration of any quality or attribute existing in him. They profess to believe in the unity of God with the abstraction of every quality and mode of existence. The Druses also believe that God has at different times appeared to men in a human form, and that his last appearance was under the name of Hakem, of Egypt, who announced himself at Cairo as a divine incarnation about 1030 A.D. They therefore regard Hakem as God, and they believe that he will one day return to earth, cause their religion to triumph and punish the unbelieving. They have neither prayers, fasts, nor festivals and with the exception of a privileged class, the Akals, or initiated, they have no worship. When they go among the Turks they behave as Mussulmans, and in the midst of the Christian community of the Maronites they enter the Christian churches and imitate the Christian believers in the use of the holy water. The uninitiated, called Jahils, are exempt from all religious duties whatever.

The Druses have also a distinctive moral code. They have seven commandments, a number taken from the sacred writings of the Mohammedans. The following, according to Hamsa, are their seven commandments, or cardinal principles: (1) Truthfulness; (2) mutual defense; (3) renunciation of all other religions; (4) separation from evil spirits and perverse men plunged in error; (5) recognition of the unity of God at all times; (6) contentment in all labors; (7) patience in all circumstances. Polygamy is unknown. They are skilful cultivators; the soil on the terraced hillsides has all been carried, with an infinity of labor, from the valleys beneath. At the end of the 16th century this people began to excite attention in Europe. In 1588 they were made tributary to Turkey by Amurath III; but in the beginning of the 17th century recovered their independence under the renowned Emir Fakreddin and reached the summit of their power; but this leader was in 1635 strangled at Constantinople, and although other princes were placed over them, they never recovered their former reputation. They endeavored, indeed, by the assistance of the Russians in 1773, to regain their freedom; but they were soon obliged to become again dependent on the Turks. Troubles have more than once broken out between the Druses and the Maronites, their neighbors. An outburst of this kind occurred in 1860 and fearful atrocities were perpetrated upon the unhappy Maronites, who, however, seem to have been also aggressive. About 12,000 Maronites were killed and a large number were driven from their homes. A French force was

sent out and tranquillity was restored. Disturbances occured also in 1895–96.

Consult Bell, 'The Desert and the Sown' (London 1907); Churchill, 'The Druses and Maronites under Turkish Rule' (London 1863); Ewing, 'Arab and Druse at Home' (London 1907); Oliphant, 'Land of Gilead' (London 1880).

DRUSUS, Nero Claudius, Roman general: b. 38 B.C.; d. 9 B.C. He was the first Roman general who penetrated the German Ocean. He became prætor (11 B.C.), but returned in the next spring to Germany, subdued many tribes as far as the Weser, and commenced the erection of fortresses. On this account he was appointed proconsul; the army saluted him with the title of *imperator,* which was not, however, sanctioned by Augustus. In 9 B.C. he was made consul, but returned soon after to Germany, and penetrated as far as the Elbe. The canal uniting the Rhine with the Yssel (*fossa Drusi*) was his work; and the place called Drusenheim, in Alsace, where he encamped for some time, received its name from him.

DRUZHININ, droo'zhē-nĭn, **Alexander Vasilĕvich,** Russian critic and man of letters: b. 8 Oct. 1824; d. 1864. He received his early education in his father's home where he acquired a solid knowledge of foreign languages. At the age of 16 he joined the Page-Corps where he spent his free moments in writing humoristic verses depicting scenes of the school life. After graduation he was sent to the garrison in Finland but military life did not agree with him and, in 1851, he resigned and dedicated himself entirely to literature. His first attempt in the field of fiction 'Polinka Sachs' (1847) was a masterpiece which had a brilliant success. Encouraged by that triumph the young author produced in rapid succession three novels: 'The Story of A. Dimitrievich,' 'Fräulein Wilhelmine' and 'Zhyuli.' Soon afterward he began writing criticisms in his famous 'Letters from an Out-of-town Subscriber' which, although written in a humoristic and jocular tone, were eagerly read and earned for him the reputation of the greatest critic of his time. In 1850 his very humoristic work 'A Sentimental Trip of Ivan Chernokozhnikov' produced a scandal in the literary circles of the capital, but nevertheless gained great popularity for its author who often afterward took 'Chernokozhnikov (the 'Red-Skinned one') as his favorite pseudonym. As editor of the magazine *Biblioteka Dlya Chtĕniya,* he translated magazine dramas of Shakespeare and wrote a number of essays on English literature. As a novelist he is profuse, verbose and heavy and shows a powerful, though not beneficent, influence of English master novelists. But as a critic he is a stubborn defender of the "purely artistic" in literature condemning the didactic element which prevailed in a large measure in the Russian literature of his time. He asserts that the author's creation wing is criminally curtailed by a vain desire to educate his readers. By means of his elegant tone, unimpeachable impartiality, subtleness and astuteness, he obtained even from his adversaries the epithet of "honorable knight." Consult Starchevski, A. B., 'Nabludatel,' (1885, Nos. 4 and 5); Kiprichnikov, A. I., 'Istorich, Vyestnik' (1884, No. 4).

DRY CARBON PROCESS OF ARMOR PLATE. See ARMOR PLATE.

DRY DOCK. See DOCK.

DRY FARMING. The phrase "dry farming" is a misnomer, for it implies the growing of crops without the use of water, which is altogether impossible. But in United States territory west of the 97th meridian, in that region once familiarly known as The Great American Desert, the phrase is popularly used to describe all those efforts that are made to produce crops without irrigation.

Dry farming is the careful culture of the soil to the end that as large a percentage as possible of the moisture that falls be made available for the growth of the plant, instead of passing off into the atmosphere by evaporation.

The assumption behind dry farming is that moisture sufficient falls, if it can be conserved in the soil, to produce a great variety of crops where it is commonly supposed that precipitation is inadequate to supply the moisture needed by a growing crop.

It has been demonstrated after many years of experimental work in places widely scattered in what is known as semi-arid America that a very large percentage of the moisture that evaporates from the soil can be conserved by intensive cultivation of the soil. If the soil is tilled intensively 12 inches of precipitation are sufficient in the semi-arid portions of the United States to produce crops adapted to a particular locality. Over a very large portion of the semi-arid area of America the annual precipitation ranges from 12 to 24 inches.

The importance of dry farming in the economic development of the western part of the United States may be appreciated when it is known that more than one-third of the total land area of the nation is contained within the area once known as The Great American Desert and now called semi-arid America. There are upwards of 600,000,000 acres in this region, a goodly portion of which can be made useful for agriculture by now known methods.

There was formerly a popular idea to the effect that precipitation in what is known as the semi-arid regions of the United States was not sufficient to make agriculture possible and profitable. This idea is erroneous. Over more than half the total semi-arid area — the northern half — the annual precipitation in form of both rain and snow is sufficient, when coupled with intensive soil culture and seed selection, to make general farming as great a success as it now is in the great prairie states of the Middle West.

Summer Culture.— The purpose of summer culture is to store up in the soil one season's moisture before a crop is planted, though it does not follow that no crop should ever be planted on newly-broken prairie. In fact a crop of peas does very well on such land and the same fall a crop of wheat may be planted with excellent results, if surface cultivation is carried on the following spring before the wheat is very high.

If the field is summer tilled for the purpose of storing moisture, it should be plowed again about eight or nine inches deep. This time the plow should be followed by an implement with wedge-shaped wheels turning on an axle known as the subsoil packer. It presses the soil down-

ward and sideways at the same time, but it does not pack the surface. It leaves this loose and open and the harrow completes the work of creating the soil mulch again.

This sub-surface packing is regarded as very important. All water moves in the soil as oil moves up a lamp wick, by what is known as the process of capillarity. If the solid soil column is interrupted or broken by large air spaces beneath the surface, the movement of the moisture will be interrupted, and large air spaces in the sub-soil tend to increase the evaporation, for they suck up the moisture from below.

It is not considered absolutely necessary to the success of dry farming to summer till for one whole season in advance of planting a crop as outlined here. But unless the farmer intends to devote himself assiduously to the cultivation of the acreage which he plants after carefully preparing the seed bed, it would be far better to summer till — that is, produce no crop the first season but harrow the ground frequently and store the moisture that falls.

Fundamental Principles.— The principles that have been developed have undergone an evolution. It was at first believed by many that spring plowing was most advantageous, so as to open up the soil for moisture, but it developed that the best results were had by fall plowing, which allowed the snow and water to gather and lie in the furrows through the winter, and to follow with regular cultivation in the spring, especially after rains. It also developed that deep plowing secured better results than shallow plowing, and that the sooner after harvest the plowing was done, the more moisture was conserved.

As soon as the crop is harvested, in fact on the same day, the stubble should be disced so as to again create a mulch and check evaporation from below. When a hot July sun falls upon the open surface of a grain field that has been protected by the grain itself from the sun's direct rays for so long, the rapidity with which moisture leaves the soil and is absorbed by the atmosphere is incredible. As soon as possible after the work of discing has been completed the field should be plowed to a depth of eight or nine inches, the sub-surface packer again brought into use, the surface harrowed, and the crop planted.

Late winter seeding is now strongly urged, and is becoming the established practice. It has been demonstrated that thin seeding is far better than strewing plenty of seed, on the theory that the plants, having scanty moisture to draw upon, should not be crowded.

In western Kansas and Nebraska and eastern Colorado and northern New Mexico fall wheat should be sown from the 1st till the 20th of September. Early the following spring the field should be harrowed several times till the wheat is large enough to shade the ground well. A light steel frame harrow with levers to adjust the teeth should be used and the teeth should be set so they will lie nearly flat. This work of harrowing will not, as many suppose, destroy the growing wheat plants. On the contrary, it loosens the surface, increases the rapidity of the movement of moisture to the roots of the plants and checks evaporation at the surface due to the creation of the soil mulch, and at the same time puts the soil in such condition that it rapidly drinks in whatever moisture falls. For it is apparent that a much larger percentage of a rainfall will enter into the sub-surface of a field when the surface is loose than when it is hard and packed.

Experiment Stations.— The United States Department of Agriculture has established a series of experiment stations for testing methods and problems connected with dry farming; several of the semi-arid States have made appropriations for assisting the work; the Agricultural Colleges have lent their aid and advice; and a number of the great western railway companies have contributed funds to assist the scientific study of farming in these regions where the rainfall is slight and where artificial irrigation is impracticable. The dry farming experiment stations are increasing in number, as their value is shown. Utah has six, supported partly by the State and partly by the Federal government. It costs about $3,000 a year to run a station, which is virtually a small farm, managed by an educated man, usually a graduate of an agricultural college, whose time is devoted to whatever lines of experiment are laid out for him. The Department of Agriculture, which guides the work of these experiment stations, bends its energies mainly to soil management, cereal investigation, plant breeding, meteorological research, soil moisture determination, and bacterial studies. The bureau of plant industry has been of great assistance, and the more hardy cereals have been determined, and are generally utilized. Very numerous tests have been made of foreign cereals, known to do well on poorly watered soils.

Those types of seed that have proven themselves drought-resistant are selected. What is known as the durum wheat, imported from the semi-arid regions of Russia, or the turkey red winter wheat, are the varieties that thrive best. Kherson oats, bald barley, emmer, proso, brome grass and native blue stem are all especially well adapted to the soil and climatic conditions that prevail west of the 97th meridian.

To protect crops in flat regions, Gifford Pinchot strongly urges the planting of several rows of trees at intervals as windbreaks. This tends to decrease evaporation in the vicinity as well as affording a safeguard in heavy wind storms.

The following out of the theories thus scientifically developed has accomplished splendid results in Utah, Colorado and Montana, where there are large areas of unirrigated lands that have been utilized by dry farming methods. A great deal of land, formerly held to be unsaleable, or offered at the nominal price of 50 cents or $1 an acre, has risen in value to $5 and $10 an acre simply because of the demonstration of successful dry farming in the vicinity. In Colorado, with only a foot of annual rainfall, the 1915 wheat crop was over 12,000,000 bushels, the corn crop was nearly as great, and the oats production attained 12,600,000 bushels, while the hay crop of 2,238,000 tons was worth $17,000,000. Utah, with 16 inches of rainfall, has an annual production of over 8,000,000 bushels of oats and $8,500,000 worth of hay. Montana, with a rainfall of 13 to 19 inches, produced in 1915 26,000,000 bushels of oats and nearly 31,-

000,000 bushels of wheat, besides over $15,000,000 worth of hay. Such results speak volumes for intelligent methods.

Dr. John A. Wiltsoe, president of the State Agricultural College of Colorado, and author of the arid-farm law of Utah, advises that profitable farming by dry methods should be possible anywhere with 12 or more inches of rainfall. He is a strong advocate of deep plowing in the fall, and emphasizes the importance of cultivation of the soil in the early spring and after every rain, in order that the moisture may be well distributed and carry the plant food where it can be reached by the young rootlets. He mentions wheat, oats, barley, rye and lucerne as the crops that yield best returns on dry soils.

A few years ago the government of British South Africa sent William Macdonald on a tour through the semi-arid regions of the United States to study dry farming, and report whether the methods used here were applicable to South Africa, where there is much semi-arid land. Mr. Macdonald was intensely impressed with the accomplishments here, and wrote an enthusiastic report to his home government, commending the holding of annual dry farming congresses as is done in the States; advising the establishment of five dry farm experiment stations in Pretoria, modeled after the American stations; and urging the scientific study of crops suitable for South African soils.

DRY-GOODS TRADE, American. The beginning of the dry-goods trade in America dates from the time when the first colonists landed upon American shores, for it was not long after the first effort toward the settlement of this country was made that the demands for trading facilities resulted in the opening of the first store. So far as the actual trade in American textiles was concerned it is difficult to say just when or how it commenced, but as it is impossible to imagine any time when people who had been used to the advantages of civilization would not have felt the need of a place to purchase some kinds of dress fabrics, it is pretty safe to say that the original American shopkeeper was soon compelled to add such merchandise to his stock in trade, even if it did not figure in his opening announcement. Of course, in those days all stores were general stores, and merchants handled, or tried to handle, every article for which there was any great demand. As the result their stock was of a most incongruous character. There were cottons and silks from India; there were velvets and woolens from various parts of Europe, and, side by side with the most costly articles known to colonial commerce, there were groceries, hardware, etc.

In the early days of the colonies, and even for many years after the settlement of the country had assumed quite respectable proportions, but little cloth was manufactured in America. The textile trade, such as it was, was almost entirely of an import character. In the beginning the retail dealers arranged for consignments of their own, and they were naturally of small value, but soon the wholesale merchant became the importer.

So far as actual wearing apparel was concerned, the greater part was made by the people in their homes. The men of the households raised the flax or wool, which was carded, spun, and woven at home, for, at that period in our history, the distaff, the spinning-wheel, and the hand-loom occupied an important position at every well-regulated fireside. Moreover, it was by no means uncommon for the same hands that made the cloth to fashion the home-made fabrics into clothing for the use of the several members of the family. It was only the rich or more prosperous members of the community who were able to import their wearing apparel, to say nothing of their bed and table linen, and some years had passed before the customs tailor had assumed a position of any considerable commercial importance. Nowhere in America was the cultivation of cotton made a matter of much attention, and, when its manufacture in anything like an organized way began, it was, as in the case of wool, confined to a few establishments of crude construction and operation. They produced certain kinds of fabrics, it is true, but the only importance that they can have for us to-day lies in the fact that they marked the beginning of the great industries which have since been developed.

Really to comprehend the fact that the great textile industry of our own time is a matter of comparatively modern development it is only necessary to remember that the inventions of Hargreaves, Arkwright, Paul, Crompton, and Cartwright, had scarcely become known in this country at the close of the 18th century. At this time our home products were confined to a few coarse woolen cloths; a few laces, and some sundries, in silk, and nothing more than coarse sheeting and toweling in linen. In fact, during the 18th century, even our imports of foreign textiles were of most moderate proportions, being scarcely more than double the value of the home products, for it was not until some time after the close of the Revolutionary War that American imports of textiles began to show any marked increase in value. Prior to that time the value of the dry-goods imported from other countries ranged from $24,000,000 to $26,000,000 per annum, while the domestic product showed an annual value of between $12,000,000 and $13,000,000. Of course, the greater portion of this output represented the goods manufactured in the households of the country, very little of which ever appeared in the merchants' stock.

Comparatively populous as some sections of the country were, the village stores outside the centres of trade, were few and far between. Having but little demand for anything like costly grades of goods, the only textile products which they sold were the coarser textures in woolens, cottons and linens and these, with the usual supply of buttons and thread, were closely associated with the sale of rum, molasses, groceries and some few articles of hardware. People living in the small towns that were located upon the banks of the inland streams seldom had greater trading facilities than those that were offered by the flatboats which visited them from time to time with stock which was similar in character to that of the village stores. Peddlers also went through the country, thus affording the scattered inhabitants of the interior an opportunity to make some few purchases from their meagre stock of wares.

In the cities, of course, there were both wholesale and retail dealers in the various commodities. The wholesale establishments not

only imported such articles as were in most demand, but dealt in those products of home manufacture upon which they might realize the greatest profits. The shops of the retail dealers, however, resembled the country stores in that they sold almost everything that any customer might demand. It was only in the more pretentious establishments of the larger cities that there was any apparent tendency toward separate classification, in one or two instances dry-goods and notions being sold to the exclusion of everything else. In one sense of the word these conditions were largely due to the circumstances of the people. The custom of supplying as many of their wants as possible by the use of articles manufactured at home naturally reduced the sale of shop-made products, while the habit of trading by barter, instead of for cash, also had a tendency to retard the development of any large retail establishments.

During the five-year period prior to 1800, the imports of foreign merchandise paying ad valorem duties into the United States aggregated $212,000,000, of which the textile imports represented about two-thirds. New York then, as now, was the chief importing city of the country, and the kind and character of the importations were cottons, woolens, silks, velvets, linens, laces, edgings, hosiery, gloves and shawls, including damasks, dimities, callimancoes, durants, tabarets, platillas, listadoes, mamoodies, gurrahs, cossas, baftas, russets, satinets, duffels, britannias, etc. These goods came chiefly from India and China, and from the cities of Amsterdam, Hamburg, London and Liverpool, and the most important importing houses in New York were those of Bethune & Smith, Murray's Wharf; John Knox, 97 Water street; McCready & Reid, 97 William street; Hector & Scott, 125 Pearl street; John & William Tabele, 260 Pearl street; Benjamin I. Moore, 103 William street; Charles J. Vogel & Company, 92 Maiden Lane; Richard & John Thorne, 141 Pearl street; William Blackstock & Company, 163 Pearl street; A. S. Norwood, 127 William street, and Robert & John Sharp, 93 Maiden Lane. Of these firms, A. S. Norwood dealt extensively in carpets and rugs, besides handling dry-goods more largely, perhaps, than any other house, while, among the other firms that sold dry-goods in connection with other foreign and domestic commodities, one must mention those of Archibald Gracie, 52 Pine street; James Stuart, 10 William street; Eben Watson & Company, 36 Old Slip; Ferguson & Crichton, 84 Broadway; Rogers & Lambert, 232 Pearl street; H. G. Rutgers & Company, 145 Pearl street; Rutgers, Seaman & Ogden, 93 Front street; Thomas Buckley, 241 Front street; Suydam & Wyckoff, 21 South street; Robert Weir & Company, 16 Gold street; John Knox, 97 Water street; Thomas Warren, 61 Maiden Lane; John McGregor, 84 Broadway; as well as Minturn & Barker, Thomas Napier & Company, Robert Lennox, Frederick de Peyster, Gouverneur & Kemble, John Murray & Sons, and others.

The 15 years that elapsed between the beginning of the century and 1815 witnessed some trying ordeals for the trade and industrial interests of this country. These troubles began with the French complications; they were accentuated by the Embargo and Non-Intervention acts, and they finally culminated with the war with Great Britain. With such restrictions upon our import trade, the wholesale business of the country stagnated, but, as was quite natural under such conditions, the effect had a tendency to foster our home industries. In 1803, our trade interests, both at home and abroad, were seriously influenced by the panic in Great Britain. In 1804 the first consignment of American cotton was made to Elijah Warren, of Philadelphia, Pa., by Almy & Brown, of Providence, R. I., and the former at once became their agent for yarns and thread, and finally, for stripes, plaids, checks, tickings, ginghams, etc. During the next two years, however, the value of domestic cottons, produced by the New England factories and sold in Philadelphia, amounted to only $17,670.

When the Embargo went into force, in 1807, our foreign trade, as a matter of course, was almost entirely suspended. At this time, however, there were not more than 4,000 cotton spindles in use in the entire United States, for progress in this line of industry had been slow. Before the close of the year, however, the number had doubled, and, by 1809, there were no less than 17 mills in operation in Providence, R. I., with 2,296 spindles, producing fully 510,000 pounds of yarn. About 1,000 looms were also in operation weaving cotton cloth.

The census report for 1810 gave some very clear evidence of the more or less rapid advancement that had been made in all the branches of the textile industry, especially in the manufacture of cottons and woolens. According to the report of the Treasury Department, the American product in cottons and woolens, exclusive of clothing and other goods, amounted to scarcely less than $46,000,000, in 1810. Eli Whitney's invention of the cotton-gin had effected such a change both in the production and manufacture of cotton that it had suddenly become one of the nation's leading products.

During the period immediately following the war with Great Britain the importation of foreign goods increased so enormously that the market was not only glutted, but both the cotton and the woolen industries were paralyzed. In fact, so great was the fall in prices that many of the leading importers were almost ruined, while there were but few merchants who were not seriously handicapped by the general stagnation in nearly every line of trade. While this condition of affairs was partly due to the result of the war and the sudden reopening of our ports to foreign trade, this was by no means the only or most serious influence which was at work. To tell the truth it is necessary to admit that the business woes of the republic were largely the result of a combined effort on the part of the foreign manufacturers to gain control of our markets. The reopening of American ports had given them the opportunity for which they had long been making preparations. The ad valorem rates of duty which then prevailed were low, and they seized the chance to unload the surplus stocks, which they had been quietly accumulating, upon the markets of the United States, with a view to crippling its textile mills and thus securing the trade of the country. The plot, serious as its effect was upon American business affairs, was successful,

not only for the time, but for several years succeeding 1815.

The census reports for the decades ending with 1820, 1830, 1840 and 1850, give little useful evidence respecting the advancement in the textile industries. We may judge that it was both steady and gradual by the record given of the increased production of the spindles and looms of the country, especially so far as cotton and woolen products were concerned, but it was not until the year 1850 that these manufactures reached the point at which it was possible to plan for a broader national and industrial development. Many important processes and inventions were also perfected during this time. Among these innovations there was the sewing machine, the power-loom, the knitting machine, and several other labor-saving devices which had a marvelous effect upon the future growth of the textile interests.

The history of American industries during the first half of the 18th century is a record of almost countless vicissitudes for which such events as wars, panics, financial depressions, conflagrations, and other adverse conditions were responsible, but, instead of being discouraged by such experiences with unavoidable misfortunes they seem to have had a tendency to spur the manufacturers and merchants to more united efforts. In the latter years of this period the inauguration of improved methods, not only in the matter of manufacture, but also in the distribution and sale of all products, tended to bring about a finer classification of goods than had hitherto been carried out, and, for the first time in the history of trade in this country, both the wholesale and the retail dealer began to make more or less separate distinctions in the goods which they sold. Importers and wholesale dealers began to handle special or distinct lines, such as silks and dress-goods; cloths, coatings and cashmeres; notions and small wares; hosiery, underwear and gloves; laces and embroideries; white goods and linens; or hats and caps. Gradually, moreover, the same well-defined distinctions came to be recognized by the retail trade in the cities, although the stores in the various towns and villages throughout the country continued to follow their original policy of carrying a miscellaneous stock of merchandise. The inception of the clothing trade, and, later, of the ready-made articles for women's and children's wear, helped to make the classification still more minute, while the inauguration of the commercial traveler system, and the general utilization of the commercial agency which followed, were important factors in helping to bring about the new conditions, the dawn of which was heralded in 1850. In this year the value of our cotton and woolen products amounted to fully $112,000,000, while the total output of our combined textile interests aggregated $129,000,000. At this time our imports of foreign dry-goods approximated $59,000,000.

There were, of course, several factors which played a part in that betterment of conditions that began to be apparent about the middle of the century. The opening of the South and West, the establishment of new towns occasioned by the institution of new industries, and other evidences of prosperity, resulted in a larger and more diversified demand upon the manufacturers. Prior to 1850, practically no domestic commission business had been done in New York. Transactions of this kind had been confined to Boston, Baltimore and Philadelphia. The bulk of the product of the New England mills went to Boston. Philadelphia, which had some 20 commission houses engaged in the sale of domestic goods, was the chief market for that product which was then designated as "blue goods," and which included denims, checks, stripes, etc. At this time large quantities of dry-goods were also sold at Hartford, Conn., but New York, which had always been the centre for imported goods, was not recognized by the domestic commission houses until the early fifties, when some of the Boston establishments opened branch offices in that city. Immediately, however, these offices sprang into such importance that it was not long before they were doing a greater bulk of business than the parent houses, and it was due to this reason that, one by one, the great Eastern mills began to open regular agencies in New York. In those days New York was so confined as to area that there were no retail houses above Howard street, and all the wholesale and jobbing business was conducted further down town, largely on lower Broadway, Cedar, Pine, Liberty, and Broad streets.

In the memorable panic of 1857, when all the business interests of the country were paralyzed, the dry-goods business was one of those that suffered the most severely. The trouble started with the failure of the Ohio Loan and Trust Company, on 27 August, and it attained its most serious proportions in the month of October, when the numerous failures and the hair-breadth escapes from ruin tried men's souls as well as their bank accounts.

According to the reports for 1860, the imports of dry-goods into the United States amounted to a little more than $112,000,000, while the total value of our own textile manufactures were about $215,000,000. Compared to the figures for 1795, the former had increased nearly fivefold, while the latter was almost 18 times greater.

Then came the outbreak of the Civil War, and, during that memorable struggle for the preservation of the Union, the dry-goods interests were again affected. Beginning in December 1861 the value of cotton goods continued to increase, until, at the end of two years, the price of such products had risen nearly 300 per cent. The year 1863 showed a still sharper rise, and the increase in price culminated in the fall of 1864, when the average increase in the cost of cotton goods had attained a mark of nearly 1,000 per cent. Even raw cotton, in April 1864 sold at $1.90 per pound. In Europe this period is still remembered as the "days of the cotton famine," for shipments of this staple from the United States had been almost entirely suspended since the beginning of the conflict between the cotton-using North and the cotton-producing South.

Lee surrendered on 9 April 1865, and by 30 June the price of cotton had fallen to 40 cents per pound. So far as manufactured cottons were concerned, however, no proportionate decrease in price was shown for some time. In October cotton was quoted at 64 cents per pound, but the price of prints, sheetings, etc.,

had fallen less than half from the price that had been current for them in 1864. It was during this year that one dry-goods jobbing house distributed goods broadcast throughout the country to the aggregate amount of $72,000,000. In 1870 the imports of dry-goods amounted to only $98,290,000, an increase of fourfold over the record for 1795, while the aggregate product of the home manufacturers was $520,000,000, or an increase of nearly 2,500 per cent.

There are several reasons that might be cited to explain why the dry-goods industry did not show a corresponding increase during the next decade in the history of the country. In the beginning, it must be remembered that American manufacturers were compelled to face some very serious vicissitudes. The period immediately following the war was a most uncertain one. Moreover, the increased production of the country, to say nothing of the improvement and cheapening of the facilities for manufacture, naturally had a tendency to bring about a decline in all classes and kinds of textile products. Thus, while there was really a noteworthy increase in the quantity and variety of America's manufactures, the value of the output indicated but little augmentation. In 1880, therefore, the value of our textile products was but about $533,000,000, an increase of less than $13,000,000 over the record for 1870, while the importations of foreign dry-goods amounted to almost $136,000,000, or an increase of nearly $38,000,000.

It was during the next few years that the dry-goods industry began to attain a more stable position in the commercial world, and, with better financial conditions and more modern methods, not only in the manufacture, but also in the art of transacting business, the growth of these interests was a steady record of prosperity. That it has since attained to considerable proportions one may easily discover by reference to the later census reports, for the value of the American output, which, in 1890, was $1,261,672,504, by 1900 had attained the still more enormous figure of $1,637,484,484.

In this review of the history of one of the nation's greatest industries, only the textile branch of the subject has thus far been considered, whereas the dry-goods merchants of today handle a multitude of articles that cannot be included in this classification. In fact, the disposition that has been shown by the large retail houses to buy and sell promiscuous merchandise, intermixing dry-goods proper with many different lines of trade, makes it almost impossible to secure anything like exact figures respecting the value of the annual distribution of wares through these sources. The latest census report divides the American manufacturing industries into 363 distinct classes, and, of these, fully one-sixth enter into the province of the modern dry-goods business.

The present tendency of the trade is away from the designation «dry goods.» The United States census no longer makes returns under this title. The old-time dry-goods stores have developed into department stores, and the smaller concerns are notion stores, while men's clothing and women's cloaks and suits are sold in stores and by mail without any thought of being a part of the dry-goods trade. In the 1903 edition of this encyclopedia it was noted that the number of dry-goods stores then was decreasing, and the decrease continues. Trade grows but it differentiates and much of it is no longer denominated dry-goods. True, there are prosperous dry-goods journals, but the name is becoming a misnomer for them, as they are developing into costume journals, supported by the advertising mainly of manufacturers of all classes of apparel. The day of buying goods by the yard over the counter for household use, which characterized the dry-goods stores of the seventies, is gone. Nearly all textiles and fabrics are now made up in factories and sold as the completed articles. There are still a few old-fashioned people who go and pick out the goods and have them made up to order, but the multitude like to buy made-up goods, because they can see the finished article and can get it quickly. Because of the tremendous expansion of business and of new methods of manufacture and sale; because of the scientific development of advertising and frequent changes of styles; and because of the vastly increased number of wants of modern civilized humanity, the dry-goods trade is being lost in a mutiplicity of subdivisions, and as an entity appears to be doomed, just as wet goods, as a designation of a class of business, has disappeared. See CLOTHING INDUSTRY; COTTON; CARPET AND RUG INDUSTRY; TEXTILES; LACE; LOOM; SILK; WEAVING.

DRY PILE, a very interesting form of galvanic battery, invented by De Luc, so named from the fact of its requiring merely a slight moisture among its leaves. Various kinds of dry piles are constructed. A very excellent one, Zamboni's dry pile, is made in the following way: Some sheets of «silver» paper, covered on one side with zinc foil, are moistened on the back with honey or glycerine and water, and then rubbed over with very finely-powdered black oxide of manganese. These are laid one on the top of the other, the silvered side of one being in contact with the oxide of manganese of the next. They are then cut with a punch into discs of about an inch in diameter and they are put into a glass tube, care being taken that the order just mentioned is preserved. The tube is varnished with shellac inside and out and is fitted at each end with a brass cap through which passed a brass piston which is set down firmly against the paper discs in the tube and furnished with an outer knob. From 1,000 to 2,000 discs may be used. The knob at the oxide-of-manganese end will be found positively electrified, the other negatively. A pile containing 2,000 discs will charge a Leyden jar. A pile of 40,000 discs was strong enough to emit a succession of sparks three-fiftieths of an inch in length, to charge a Leyden jar of 50 square inches capacity, and thence to fuse one inch of fine platinum wire. The honey with which the paper is saturated is intended for a hygrometric substance. If the pile be carefully kept it will preserve its power for many years. A pile of this type with 20,000 discs has kept a pendulum vibrating between two bells so as to keep up a perpetual ringing for several years. If it be artificially dried it loses it, but will frequently regain it when a sufficient amount of moisture has been absorbed from the air. Its action is similar to that of a galvanic battery, but seems to have no chemical

effect, as saline solutions subjected to its current for several days remain unchanged; and the most delicate vegetable coloring matters are unaffected. An examination of the pile shows that it resembles a conductor, neutral at the centre, one extreme negative and the other positive. The activity of the instrument is increased by artificial heat and is more marked in summer than in winter. The principle of the dry pile is made use of in Bohnenberger's electroscope. Two short dry piles are set side by side an inch or so apart, with opposite poles uppermost, the whole being covered with a bell glass. Through the top of the bell glass passes a rod having a knob at its upper extremity and a strip of gold leaf at its lower end, hanging between the poles of the dry piles. Then any substance even feebly electric is brought close to the knob, the gold leaf instantly announces its electrical nature, whether positive or negative, by flying to the pile which presents the opposite phase of electrification. This electroscope is regarded as more sensitive than any other. See ELECTRIC BATTERY; ELECTRICITY; ELECTRIC STORAGE BATTERY.

DRY POINT, a sharp-pointed steel needle or instrument used by engravers to incise fine lines directly upon the copper plate without first coating it with etching-ground. The dry point does not cut into the metal but divides it, forming a sort of furrow with elevated ridges on each side. These are afterward scraped off where the effect is to be gray, but left standing for strong velvety blacks. This tool is much employed in working the more delicate portions of etchings or in making whole pictures on copper, called "dry-point" etchings, and very frequently also as a retouching tool on acid-bitten plates.

DRY POINT ETCHINGS. See ENGRAVING.

DRY ROT, a popular name for the decay of seasoned timber and for certain forms of decay of the trees while still standing. The latter kind is caused mainly by species of shelf-fungi and toadstools, which also attack the stumps of various trees. Sap rot (*Polystictis versicolor*) is the most serious of all, destroying 75 per cent of railroad ties in use. Economically, the former kind is the more important, since it attacks timber after it has been put in place in buildings. In such cases the floors or walls may collapse with more or less damage to property, if nothing worse. The fungi producing this kind of dry rot are species of the genera *Polyporus* and *Merulius,* which produce similar effects. The most common is *M. lacrymans.* The spores germinate in the presence of moisture and the branching threads (*mycelium*) penetrate as far as the wood is moist, later spreading into broad sheets and completely destroying the fibre of the wood. The fungus is at first white but later turns brownish-red, producing what is called "red-striped" timber. Drying only temporarily checks growth, for when moisture again reaches the wood the fungus recommences its work of destruction. The wood exposed to frequent changes of moistening and partial drying is most susceptible. But if properly seasoned and then protected by antiseptic treatment or good paint, will be exempt unless the fungus has already gained entrance. In floors and walls only dry and non-alkaline sound-deadening substances should be used, since these do not favor the germination and growth of the spores which may be present. Both Merulius and Polyporus are classed with the poisonous fungi.

DRY TORTUGAS, tôr-too'gąs, Florida, a group of small coral keys or islets, 10 in number, at the western end of the Florida Keys, in the Gulf of Mexico, about 70 miles from Key West, lat. 24° 36′ N.; long. 82° 54′ W. The principal keys are East Key, Bird Key and Loggerhead, and are a part of Monroe County. During the Civil War the Federal government confined prisoners at Fort Jefferson, on one of the islands, and this practice has been continued. It also serves as a quarantine station. A marine laboratory has been located at Loggerhead Key since 1904 and the entire group has served as a Federal bird station since 1908.

DRYAD, in Greek mythology, a nymph of the woods; a deity supposed to preside over the woods; a wood-nymph. Dryads differ from hamadryads in that the latter were attached to particular trees, with which they were born and died.

DRYANDER, drü-än'dėr, **Ernst,** German Protestant theologian: b. Halle 1843. He received his education at Halle and Tübingen and was pastor of the Evangelical congregation at Bonn from 1879 to 1882. In the latter year he removed to Berlin as pastor of the Holy Trinity church and there attracted wide attention through his eloquence in the pulpit. He was appointed court preacher in 1898, life member of the Prussian Upper House in 1901 and vice-president of the Evangelical Oberkirchenrat in 1907. He wrote 'Predigten über das christliche Leben' (3d ed., 1890); and 'Der erste Brief Johannis in Predigten ausgelegt' (1898).

DRYAS, (1) a famous Spartan, slain by Diana in the Theban War; (2) a genus of rosaceous plants found in Alpine and Arctic regions; they are small, prostrate shrubs with large white or yellow flowers; (3) a genus of butterflies, of which one species is *D. paphia.*

DRYBURGH, the ruin of a Premonstratensian abbey in Berwickshire, five miles from Melrose, on the Tweed. It contains the tombs of Sir Walter Scott and his son-in-law, Lockhart.

DRYDEN, John, English poet, dramatist and critic: b. Aldwinckle All Saints, Northamptonshire, 9 Aug. 1631; d. London, 1 May 1700. His family were landed gentry, of Puritan affiliations. He was educated at Westminster School and at Trinity College, Cambridge, where he probably continued in residence until 1657. He then settled in London, which remained his home until his death. His life is exclusively that of a man of letters, and may be divided into three periods: 1657–81, 1681–88, 1688–1700. In the first of these he is primarily a dramatist, in the second a satirist and controversialist, in the third a translator.

Dryden's first known work, a stilted elegy, 'Upon the Death of the Lord Hastings,' published in 1649, is written in a style marked by conceits of the school of Cowley, and with its harsh versification gives no promise of future

power. His real career opened with his residence in London, when he began to eke out by literary work the scanty income (about £40) that he inherited from his father. In 1659 he published his 'Heroic Stanzas consecrated to the Memory of His Highness Oliver, Late Lord Protector.' The author was probably under the influence of his uncle, Sir Gilbert Pickering, who had stood high in Cromwell's favor. In 1660, however, Dryden joined the throng of poets who celebrated the return of King Charles II, and composed his 'Astræa Redux' (1660), and his poem, 'To His Sacred Majesty, a Panegyric on His Coronation' (1661). Henceforth he was a consistent royalist, and with the possible exception of a short interval in 1680–81 a consistent member of the court party, until the revolution of 1688. His most important non-dramatic work of this period, 'Annus Mirabilis' (1667), celebrates the naval victories over the Dutch and the great fire of London in 1666. Here as in his poem on Cromwell Dryden adopts the four-line stanza of Davenant's 'Gondibert,' and shows the influence of Davenant's direct and simple style, to which he adds a vigor peculiarly his own.

After his change of politics Dryden formed new associations. He became intimate with the family of the Earl of Berkshire, and on 1 Dec. 1663 married his daughter, the Lady Elizabeth Howard, thereby gaining a substantial increase in his income. Scandal, unconfirmed by any decisive evidence, reports that Dryden's bride had been guilty of misconduct, and that the marriage proved unhappy. Dryden's numberless sneers at marriage may be only the reflection of a prevailing fashion; and surviving letters of his wife show her to have been an affectionate mother. The three sons born to her and Dryden died within a few years after their father, leaving no descendants.

At the Restoration Dryden turned to the drama as the surest avenue of success for a young author. His first play, 'The Wild Gallant' (1663), a prose comedy, was a failure; his second, 'The Rival Ladies' (1663 or 1664), a tragi-comedy in blank verse, with some scenes in rime, had better fortune. He then collaborated with his brother-in-law, Sir Robert Howard, on 'The Indian Queen' (1664), a tragedy, or more strictly a "heroic play"; and encouraged by his success, produced independently a similar play, 'The Indian Emperor' (1664 or 1665). These "heroic plays," the one type of drama in which Dryden excels all other authors, are always written in the heroic couplet, are half operatic in tone, and with no pretense at realism attempt to reproduce on the stage the effect of an epic poem. "Love and valor," to use Dryden's phrase, are the subjects of them; and their drawing of character is strongly affected by that of Tasso and other epic poets and by that of the French romances of Calprenède and Mlle. de Scudéry. These short-lived plays offend our present taste by their artificiality and insincerity; in their own time they pleased a public French enough to enjoy exaggerated gallantry, English enough to endure bombast and to love the sight of single combats and battles on the stage.

Dryden was now, with the possible exception of the veteran Davenant, who died in 1668, the most prominent English dramatist. About 1668 he became a shareholder of the King's Company, one of the two licensed companies of players in London, on condition of furnishing them three plays a year. This gave him an annual income of £350 or £400 until the burning of the theatre in 1672, when the profits of the company were much reduced. Though he did not fulfil his part of the contract, producing little more than one play a year, he apparently enjoyed the benefits of it until 1678, when he deserted his associates and gave his plays to their rivals, the Duke's Company. The great success of 'The Conquest of Granada' (1670), his most famous heroic play, probably helped to reconcile his partners to his small production.

Dryden's eminence was now universally recognized. In 1662 he had been chosen a member of the newly-founded Royal Society, and his early poems show his enthusiasm for natural science. In 1668 he was appointed to the positions of poet laureate, to which in 1670 was added that of historiographer royal: the two positions yielded a salary of £200. At a later date he received an additional pension of £100. But in 1671 his dramas were assailed with keen ridicule in 'The Rehearsal,' a witty farce by the Duke of Buckingham and some other writers. In 1673 he was humiliated by the success of a poetaster, Elkanah Settle, with a bombastic play called 'The Empress of Morocco.' When Dryden joined Shadwell and Crowne in writing a pamphlet ridiculing this drama, Settle retorted with equally pungent satire on 'The Conquest of Granada.' By the contest the laureate had lowered his dignity and had gained nothing. Dryden's ideas were also affected by French critical works published at this time. Hence in 'Aureng-Zebe' (1675), his next heroic play, he adopted a more natural style and then abandoned the type altogether. In 'All for Love' (1677) he treated in blank verse the familiar subject of Antony and Cleopatra, and imitated with real success the style and character-drawing of Shakespeare, but the dramatic technique of Corneille and Racine. This play remains the masterpiece of Restoration tragedy, the finest result of the French influence on the English serious drama. Of the plays that followed the most important is 'The Spanish Friar' (1680 or 1681), a tragi-comedy which has great merits of style and contains Dryden's best comic writing.

In 1668 Dryden had published his most important prose work, 'An Essay of Dramatic Poesy.' This is designed to uphold the reputation of English dramatists and to defend its author's principles of composition. Here and in numerous smaller critical writings, which he continued to publish all through his life, Dryden showed himself a perfect master of his "other harmony" of prose. In critical work his style has never been surpassed for ease, grace and unassuming dignity. It is of so modern a type that, with the exception of an occasional phrase, it might seem the creation of a great artist of our own day.

Already a man of 50, Dryden has as yet produced none of the poems on which his permanent fame was to depend. In 1681 he turned from the drama, of which he was thoroughly weary, to political satire, and brought all his skill to the aid of the Tory government. After the defeat of the Whigs in their effort to ex-

clude the Duke of York from the succession in favor of the Duke of Monmouth, their leader Shaftesbury was accused of high treason and in November 1681 his case was brought before the London grand jury. At this time Dryden issued his 'Absalom and Achitophel.' In this finest of political satires (written, like nearly all his later work, in the heroic couplet, and containing about 1,000 lines), under the transparent veil of a scriptural allegory, he gives portraits of the leading politicians of the time, among them his old foe, the Duke of Buckingham. Absalom represents Monmouh; Achitophel,

> "For close designs and crooked councils fit,
> Sagacious, bold, and turbulent of wit,"

Shaftesbury himself. Though the poem had a wide sale and probably affected public sentiment to some degree, it failed of its immediate object, since the grand jury refused to indict Shaftesbury. When the latter's friends had a medal struck to commemorate his liberation, Dryden published a second satire, 'The Medal' (1682), hardly inferior to its predecessor. In reply, the Whig poet Shadwell, once Dryden's friend, assailed him with scurrilous abuse in 'The Medal of John Bayes.' Dryden now turned against Shadwell his tremendous powers of invective and in 'Mac Flecknoe' secured for him an unpleasant immortality. He closed this series of great satires by some 200 lines contributed to a second part of 'Absalom and Achitophel' (1682), by Nahum Tate, in which he again attacks Shadwell and his other enemy, Settle, under the names of Og and Doeg. At about the same time he turned to didactic poetry and in 'Religio Laici' gave a versified defense of the doctrines of the Church of England.

In February 1685, the Catholic James II ascended the throne. During the same year Dryden became a Catholic. For this conversion he has been denounced by judges whose opinion commands our respect as a hypocritical time-server. Perhaps he himself could not tell whether he changed his religion from conviction. Brought up a Puritan, he was by nature a sceptic. His morals were probably little better than those of the dissolute young noblemen whose associate he was proud to proclaim himself. Such a man could have no clinging attachment to the Church of England. On the other hand, with his strongly logical, scholastic temperament, once he had admitted the element of mystery in religion, he could find it possible to accept any of the Catholic dogmas. He would probably not have become a Catholic except for the pressure of external circumstances; on the other hand, in accepting the king's religion he probably was guilty of no moral obliquity. All his work shows a steadily increasing acceptance of the principle of authority, in literature as in religion. He gained no new offices or pensions as the price of his adoption of Catholicism: whether, without this change of faith he would have been deprived of those that he already possessed, it would be idle to discuss. After the revolution he was steadfast in his adherence to his new faith.

Dryden's conversion bore fruit in 'The Hind and the Panther' (1687), his longest original poem. The scheme of the work, a polemic dialogue between the Hind, representing the Catholic Church, and her adversary, the Panther, or Church of England, is absurd enough; but the book contains some of Dryden's best poetry. His defense of his own sincerity shows fervor and pathos, almost sublimity; it is his nearest approach to the "grand style."

The revolution of 1688 brought ruin to Dryden's wordly prosperity. Already an old man, he was deprived of his salary and his pension and except for a wholly inadequate income from his landed property, was thrown back on his pen for support. He met the situation with dignity, making no attempt to conciliate the new government, but refraining from any attack on it. He returned to play-writing, on which since 1681 he had done almost nothing. But his latest dramas, though one of them, 'Don Sebastian' (1689), rivals 'All for Love' in poetic merit, had comparatively small popular success. He found a surer support in work as a translator. This he had begun in 1680 with three pieces in a small volume of 'Ovid's Epistles,' and had continued by various contributions to poetical miscellanies. He now undertook, with aid from other "eminent hands," a complete version of Juvenal and Persius, which was published in 1692. Dryden himself translated five satires of Juvenal and the whole of Persius, and wrote a long prose preface on 'The Original and Progress of Satire,' compiled from Casaubon and other scholars. He next turned to what is perhaps his greatest single achievement, a complete translation of Virgil, which he began in 1693 and which appeared in a stately folio volume in 1697. This work was hailed with enthusiasm on its appearance, and has never been superseded as the standard English version of the greatest Latin poet. Dryden's 'Virgil' has indeed none of the grace, tenderness and "high seriousness" of the original; in the 'Bucolics' and 'Georgics' it is markedly inferior. But his 'Æneid' is a masterpiece of animated narrative; the easy, buoyant verse carries the reader forward with no thought of constraint.

In the same year Dryden produced his great ode, 'Alexander's Feast,' the finest lyric poem of the period between Milton and Wordsworth. He adopts the irregular "Pindaric" structure made fashionable by Cowley, but transforms it by his own genius. The poem is not easily appreciated by modern readers, who in lyric poetry instinctively look for either the expression of moral ideas (Wordsworth), of intense passion (Shelley), or of sensuous beauty (Keats). Dryden gives none of these, but instead a rapid series of flashlight pictures, each expressed in verse that by its music suggests the scene described. No poem has a more youthful vigor than this ode by the weary dramatist and satirist of sixty-six.

Dryden next set to work on a volume of translations and adaptations from Chaucer, Boccaccio, Ovid and Homer that was published in 1700 under the title of 'Fables, Ancient and Modern.' This last product of his pen has an enduring charm. Here the old poet is a teller of tales in clear, simple, melodious language, such as was not to reappear during the whole century that followed him.

Dryden died on 1 May 1700. After an impressive funeral he was laid to rest in Westminster Abbey, in the "Poets' Corner," near the grave of Chaucer.

After the death of Milton in 1674 Dryden was the acknowledged chief of English men of letters. During the 18th century his fame even increased, so that when Scott wrote in 1808 that Dryden left "a name second only to those of Milton and Shakespeare," he merely echoed a received opinion. With the rise of romanticism, Dryden's reputation sank, until to-day he is probably the least read of the greater English poets; certainly far less than Pope, with whom it is most natural to compare him. He indeed lacks the highest poetic qualities. He expresses no great moral or social ideas; he had little sympathetic or intuitive knowledge of human nature,—hence the comparative weakness of his dramas,—and no feeling for the beauty of the external world. His greatness is primarily one of technique. He had a sense of style, a literary temperament, an ardent love for good literature, which increased in him with advancing years. Owing to this he gradually developed a poetic diction of his own, which, with its clearness, strength and genuine, though restricted melody, became the model for Pope, and so, directly and indirectly, for the whole 18th century.

As a critic, Dryden is of the highest rank. Himself familiar with contemporary French critics, he did much to introduce their ideas into England. Hence Dr. Johnson terms him "the father of English criticism, the writer who first taught us to determine upon principles the merit of composition." Yet, though the founder of English dogmatic criticism, Dryden was himself no dogmatist; continually shifting his point of view, he can be classed as a disciple of no one school. Unlike his successors, he distinctly recognized that literary ideas are necessarily modified by changing conditions of time and country. A lover of all the great English poets, he has left appreciations of Shakespeare and Chaucer that in their way have never been surpassed.

In person Dryden was short and plump; he retained his rosy cheeks until past middle life. He was a man of kindly nature, whom his companions loved, and whom his enemies hated rather because of literary and political rivalry than for any personal reasons. He is best remembered not as a successful writer of indecent comedies or as a fierce controversialist, but as a genial old man, enthroned in his great chair at Will's Coffee House as "judge of wit." See ABSOLOM AND ACHITOPHEL; ALEXANDER'S FEAST; HIND AND THE PANTHER, THE; MAC FLECKNOE; ALL FOR LOVE.

Bibliography.—*Editions:* The only complete edition of Dryden's works is that of Sir Walter Scott (18 vols., Edinburgh 1808 and 1821), re-edited by Professor Saintsbury (Edinburgh 1882–93). Saintsbury retains all Scott's material and makes numerous corrections and additions, but is not always trustworthy in details. Of the poems aside from the dramas, there are four easily accessible editions. The most complete is the Cambridge edition, edited by G. R. Noyes (1 Vol., Boston 1909); it contains all Dryden's poems and poetical translations, together with about half of his prose essays. The Aldine edition (5 vols., London) omits the 'Virgil,' and the Globe edition, edited by W. D. Christie (1 vol., London 1870, and often reprinted) omits all the translations from the Greek and Roman poets. These three editions are all in modernized spelling; they contain good notes and biographical introductions: the Cambridge edition includes the essentials of the commentary contributed by Scott and Christie. The Oxford edition, edited by John Sargeaunt (1 vol., Oxford 1910), reprints in the original spelling the poems and poetical translations, except the 'Virgil,' but contains no memoir or explanatory notes. The 'Virgil' is included in the World's Classics series (1 vol., London 1903). Saintsbury has edited eight of the best dramas in the Mermaid series (2 vols., London 1904). G. R. Noyes has edited five of the best dramas, with Buckingham's 'Rehearsal,' in 'Selected Dramas of John Dryden' (Chicago 1910). W. P. Ker has edited the most important prose works in 'Essays of John Dryden' (Oxford 1900). The text of most of these is also given in Everyman's Library, No. 568. *Biography:* Sir Walter Scott's 'Life of Dryden,' in the first volume of his edition, remains the best. Dr. Johnson's (in his 'Lives of the Poets') is still valuable for its admirable criticism. It is best read in the edition of G. B. Hill (3 vols., Oxford 1905), the notes to which correct Johnson's frequent errors as to matters of fact. Malone carefully investigated all details of Dryden's life and published the results in the first volume of his edition of 'The Critical and Miscellaneous Prose Works of John Dryden' (London 1800). His work, itself unreadable, is the foundation of all later biographies. Saintsbury's account of Dryden in the English Men of Letters series contains good literary criticism. *Criticism:* There are notable essays on Dryden by Macaulay, Lowell (in 'Among My Book') and J. C. Collins (in 'Essays and Studies,' London 1895). Beljame, in his 'Le Public et les Hommes de Lettres en Angleterre au dixhuitième siècle' (Paris 1883), gives an invaluable account of the poet's work as conditioned by his environment. See also Frye, 'Dryden and the Critical Canons of the Eighteenth Century' (Lincoln, Neb., 1907). A bibliography finds a place in the 'Cambridge History of English Literature' (New York 1912).

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DRYDEN, John Fairchild, American insurance expert: b. near Farmington, Me., 1839; d. 1911. He was educated at Yale and entered the insurance business. He founded the Widows and Orphans' Friendly Society in 1873, which was succeeded in 1875 by the Prudential Life Insurance Company. Under his management this company became one of the greatest of its kind in the United States. In 1896 and 1900 Dryden was a presidential elector and in 1902–07 was United States senator. He became interested in several commercial and industrial companies and helped to organize the Public Service Corporation of New Jersey. He published some lectures and speeches and the volume 'Addresses and Papers on Life Insurance and Other Subjects' (1909).

DRYDEN, N. Y., village in Tompkins County, on the Lehigh Valley Railroad, 36 miles southeast of Auburn; noted principally as a health resort on account of its mineral springs. The Southworth Library is a public institution.

The waterworks and acetylene-gas plant are owned by the municipality. The village of Freeville, noted for the George Junior Republic (q.v.), is nearby. Pop. 709.

DRYING MACHINERY. Drying machines and processes have become very common in the industries. Time is always a valuable element in every factory, and artificial dryers supply methods of hastening production. One of the simpler methods of drying is by gravity, as practised in the recovery of metals from slimes, by settling tanks and vacuum filters. Absorption by temporary mixture or contact with a dry, absorbent substance, as sawdust, is accomplished on the blotting paper principle in some trades. The chemist often employs a desiccating substance, as quicklime, placing it in the same vessel, below the substance which is to be dried; large clay articles, as toilet fixtures, are dried on this principle. Condensation by refrigeration is another drying process, illustrated in Gayley's air-drying apparatus for blast furnaces. (See BLAST FURNACE). A familiar form of dryer is termed the hydro-extractor or centrifugal machine. A wet substance, as laundry, is rotated in a basket at high speed, and the water thrown out by centrifugal force. Many sorts of drying mechanisms depend on natural evaporation, mechanically assisted. The atmosphere is capable of taking up moisture to the point of saturation. The more dry air can be placed in contact with a thing in a given time, the quicker will it take up the moisture so that it disappears. Therefore blowers and exhaust fans are utilized to dry wet and moist goods in a great number of manufacturing operations, on the same principle that the old-time washerwoman hung her clothes on a line in the wind. Another method is to move the goods through the air, and conveyor dryers are especially economical when the goods have to be transported to another part of a factory for a following operation. Pressure is in many cases a satisfactory means of drying. It is used in garbage utilization works to expel the moisture, as for making a fertilizer from kitchen refuse.

The application of heat is of course the most natural process of drying, and is made use of in countless ways. The steelmaker heats air in great checkered stoves to assist the operations of the blast furnace with a hot blast; boilers, radiators, stoves and heaters of practically endless forms are used in the majority of trades for drying purposes. Kilns and roasting furnaces are made with rotating cylinders through which material is passed until the last vestige of moisture is removed. Hot ovens and long heated tunnels are other devices for the same purpose. In both brickmaking and soap manufacture the hot tunnel is serviceable. The papermaker runs the continuous strip of paper from the fourdriner machine between hot calendar rolls to dry thoroughly his product in a few seconds. The lumber dealer is satisfied with storing his lumber in specially constructed buildings where the drying up of the sap can be accomplished in a few weeks or months. Manufacturers of cotton and woolen cloths, bleachers, dryers and practically all handlers of textiles have to resort to dryers to hasten their production. The printer has to put dryer in his inks, and keep his pressroom hot and his paper dry. The brickmaker, cement manufacturer, tilemaker, etc., all depend on kilns of some sort to rid their material of moisture. It would require a complete encyclopædic account of all the manufacturing processes in use to exhaust the details of methods and mechanisms for drying.

DRYNESS, in painting, a formal or hard style of drawing and lack of harmony in coloring. It is the antithesis of a free style in drawing. It is also revealed in sculpture which is wanting in roundness of form and in general softness of outline. Before the techniques of painting and sculpture were developed such dryness was almost universal, and is thus a characteristic of all early schools, although it is often found in later schools. In these its appearance is largely to be attributed to individual temperament.

DRYOBALANOPS, drī-ō-băl'a-nops, a small genus of trees found in the Malay Archipelago. The principal species is remarkable as the source of the Borneo or Sumatra camphor, which is found filling cracks and crevices in the wood. See CAMPHOR.

DRYOPTERIS, a widely distributed genus of ferns, numbering upward of 500 species, of which more than a dozen are found in the United States, including the male fern. Their only economic use is in medicine. The active principles in the male fern and allied species are filicic acid, aspidin and other phloroglucin-like bodies. The action is largely on the tapeworm, for which parasite this drug is given. Poisonous symptoms sometimes are produced. These are pain, muscular weakness, purging, collapse, and even death. Temporary blindness has been produced by male fern.

D'SA', Manoel Francis Xavier, Portuguese-Indian educator: b. Moira, Goa, 25 Nov. 1874. He was educated in the elementary schools of Moira, also at Mapuça, Saint Xavier's College, Bombay, Bombay University, and the Papal Seminary, Kandy, Ceylon. He was ordained to the priesthood in 1904, was attached to Gloria Church and has been principal of the Antonio de Souza School, Mazagon, Bombay, since 1904. He has published 'Documents concerning the Concordat of 1886' (1907); 'Difficulties Solved concerning Double Jurisdiction in Bombay' (1907); 'History of the Catholic Church in India' (Vol. I, 1910). He is a contributor to 'The Catholic Encyclopedia,' the *Catholic Herald* of Calcutta and the *Anglo-Lusitano.*

DUAL, in grammar, that number or inflection which is used in some languages when two things are spoken of, whilst another number (the plural) exists to express many. The dual in some languages is a firmly-established grammatical form, as in the classical Greek; in other languages it is used only in certain cases with certain words, or only faint traces of it are to be recognized. The Sanskrit has a dual number. Of modern languages which have a literature, Arabic is the only idiom which has retained it. The Anglo-Saxon had a dual in the declension of the first and second personal pronouns; for example, *wit,* we two; *git,* you two; *uncer,* of us two; *incer,* of you two.

DUAL PERSONALITY. See PERSONALITY AND ITS DISORDERS.

DUAL PURPOSE CATTLE. See CATTLE.

DUALINE, an explosive compound containing 30 parts of fine sawdust, 20 of saltpetre and 50 of nitroglycerin. Also called dualin-dynamite. See EXPLOSIVES; NITROGLYCERIN.

DUALISM, the philosophical opinion that the ultimate components of the universe are two in number, or fall into two fundamentally distinct classes. In modern times the line of cleavage between the halves of the dualistic world has usually separated the mental from the material. The 17th century view of the universe under the aspect of substance naturally caused dualism to assume the form of a belief in the existence of just two fundamental substances, mind and matter. This was the opinion of Descartes and of Locke. In the rationalistic school of the Continent as well as the empiricist school of Britain, it soon became obvious that the correspondences between the worlds of mind and of matter, as exhibited in experience and conduct, were not subject to an easy explanation on the basis of the existing type of dualism. Accordingly the continental rationalism was either forced, as in occasionalism, to fall back upon the honesty and the continual intervention of God, or else, as in the philosophies of Spinoza and Leibnitz, to discard dualism altogether. The British school similarly progressed out of dualism, first by Berkeley's denial of the substantial character of matter, and later by Hume's denial of the substantial character of mind. A partial recrudescence of the dualism of substance is to be found in Kant's philosophy of things — in themselves. At present a substantive view of the mind is characteristic of the dualism of William McDougall. However, it may be said in general that since the 18th century the notion of substance has come to play a progressively smaller part in the question of monism and dualism. The modern formulation of the question is: Are there two mutually exclusive orders of being, the one mental, the other material? While the agreement on this point is not by any means complete, there is a strong and growing tendency, not only among those of an absolute idealist trend of thought, but also among relativists such as William James and realists such as Holt and Perry, to regard the elements entering into the combinations of the material world and the components of mental states as not necessarily different. Mind and matter, in a philosophy of this type, are complexes of the same subject matter, but are viewed from different aspects or are ordered in a different manner.

The most interesting form of latter-day dualism is that of Bergson (q.v.). Bergson's philosophy is based on a sharp contrast between the mental, possessing the continuity of memory, which allows the present as it were to contain the past, and the material, the subject-matter of physical science, forming a kinematographic succession of spatial arrangements of particles. In his earlier writings, the distinctness of these two worlds is emphatically asserted, but more recently he has come to regard matter as an arrested, atrophied manifestation of the same vital impulse that constitutes life and mind. Bergson thus forsakes dualism for monism.

Dualism is not necessarily a cleavage along the mind-matter plane. Accordingly we find that whatsoever manifestations of dualism exist in ancient philosophy depend on an entirely different principle. This principle is the distinction between form and matter. The first crude attempts at cosmology on the part of the Ionian School brought everything back to one fundamental principle — water or air or fire or the unbounded, as the case might be. Anaxagoras made the first step toward dualism by making reason — albeit a reason or order but imperfectly distinguished from the objects ordered — the principle of the universe. Plato carried this dualistic trend to its logical consequences, and distinguished between the ideas, representing order and form, and the evil principle of not being ordered and shaped by them. While Aristotle did not directly entify his forms, he made such a sharp distinction between form and matter that he may justly be called a dualist. This dualism was accentuated in the excessive formalism of the scholastics.

Dualism is found in ethics as well as in ontology. Its ethical aspect is the recognition of separate fundamental principles of good and evil. It is especially characteristic of Zoroastrianism, and elsewhere is usually a borrowing from Persian sources. The strife between Ormuzd and Ahriman becomes in Christianity the strife between good and Satan. Manichæanism, which was peculiarly under Zoroastrian influence had this dualism as its keynote, and Satan was not so subordinated to God as in the more normal forms of Christianity. (See MONISM). Consult McDougall, 'Body and Mind' (New York 1911), and the bibliographies to METAPHYSICS and PHILOSOPHY.

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DUANE, James, American jurist: b. New York, 6 Feb. 1733; d. Duanesburg, N. Y., 1 Feb. 1797. He established a settlement at Duanesburg in 1765; took up the practice of law, and became prominent in his profession. Having bought a considerable amount of land in the territory known as the New Hampshire grants, now included in the State of Vermont, he was one of the principal advocates of New York's right to that territory; and when New York officials were driven out by Ethan Allen and his followers, Duane was the leader of those who induced the legislature to declare the Vermonters traitors and outlaws. He was elected to the first Continental Congress, and was a member of the Congress throughout its existence. He was a supporter of the conservative party, believing in the English form of government and opposed to republicanism, and he stood against the signing of the Declaration of Independence, striving to delay, and if possible prevent, separation from England. He returned to New York after its evacuation by the British, and was the first mayor under the new charter (1784–89); was a member of the committee to draft the State constitution of New York; sat in the State senate 1782–85 and 1789–90; and was United States district judge 1789–94.

DUANE, James Chatham, American military engineer: b. Schenectady, 30 June 1824; d. New York, 8 Nov. 1897. He was graduated from West Point in 1848, and was instructor there for a time. He was engineer in charge with the Utah expedition 1858, and served in the

Civil War with the Army of the Potomac and the Army of the South. In 1865–68 he had charge of the construction of defenses at the eastern entrance to New York harbor; was lighthouse engineer for the northeast Atlantic coast, and superintendent of fortifications in Maine and New Hampshire; in 1886 he became chief of engineers with the rank of brigadier-general, and retired in 1888. From 1888 to 1897 he was one of the Croton aqueduct commissioners. He was the publisher of 'Manual for Engineer Troops' (1862).

DUANE, William, American politician: b. near Lake Champlain, N. Y., 1760; d. Philadelphia, Pa., 24 Nov. 1835. He was educated in Ireland, learned printing, and in 1784 went to seek his fortune in India. He rapidly amassed property, and became editor of an Indian journal, entitled the *World*. Having taken sides against the local government in a dispute with some of its troops, he was seized and sent to England, and his large fortune was confiscated. His attempts at redress were unsuccessful, and he remained in England as editor of the *General Advertiser*, subsequently merged in the London *Times*. In 1795 he returned to America, and became editor of the *Aurora*, published at Philadelphia, which was made by his able management the most influential organ of the Democratic party; so much so, that Jefferson attributed to its vigorous support his own election to the Presidency. The change of the seat of government from Philadelphia to Washington caused the *Aurora* to decline in political importance. Jefferson appointed Duane lieutenant-colonel in 1805. In the War of 1812 he served as adjutant-general. Duane retired from its editorship in 1822, and then traveled through the republics of South America. On his return he published 'A Visit to Colombia' (1826). His other works include 'Military Dictionary' (1810); 'Handbook for Riflemen' (1813); 'Handbook for Infantry' (1813), which were for some time standard authorities.

DUANE, William John, American politician: b. Clonmel, Ireland, 9 May 1780; d. Philadelphia, 26 Sept. 1865. He was a son of William Duane (q.v.). Appointed Secretary of the Treasury by President Jackson in 1833 he was removed from office the same year because of his refusal to allow the government deposits in the United States Bank to be removed without the authorization of Congress. He served also as a trustee and director of Girard College.

DUBAN, dü-bäṅ, **Jacques Félix,** French architect: b. Paris, 14 Oct. 1798; d. Bordeaux, 20 Dec. 1870. He studied under Debret, and his first work of importance was the completion of the Palais des Beaux Arts, in the execution of which he is charged with having sacrificed harmony of proportion and strength to a fondness for ornamentation. In 1845 he was employed in the restoration of the ancient chateau of Blois, and in 1848 was appointed architect of the Louvre. The façade on the river side, and the Apollo Gallery, were restored from his plans.

DU BARRY, dü bȧ'rē', **Jeanne Bécu,** Comtesse, a French courtesan, mistress of Louis XV: b. Vaucouleurs, 19 Aug. 1746; d. Paris, 6 Dec. 1793. She was the daughter of Anne Bécu Rançon, the wife of a domestic, and because of her beauty succeeded in gaining the patronage of the Abbé Arnaud who sent her to school at a convent. Here she gained a very slight education, and left when she was 15 years of age. Her first employment was as lady's maid to Madame de la Garde, and next at a milliner's shop in the rue de Saint Honoré. Here she lived as a courtesan under the name of Mlle. Lange, and soon attracted by her charms the adventurer Jean, Comte du Barry, who made her his mistress. She presided over his gambling house with great brilliance until the fame of her beauty and wit reached the ears of King Louis XV, who immediately became enamored of her. She was presented at court and installed as his official mistress in 1769. For form's sake the king had her married to the brother of the Comte du Barry and her position was thus secured. Her influence at court became very powerful and for five years she reigned supreme. Important offices and privileges were in her gift and the courtiers abased themselves to win her regard. After the death of Louis, she retired from court to a convent near Meaux, but at the intercession of the queen was restored to the magnificent château of Luciennes. Here a throng of leading men assembled to do her homage; among them Franklin, and the Emperor Joseph II. She received also a pension from Louis XVI and her court was gay and brilliant. On the outbreak of the Revolution she fled to England, but returned to attend to the matter of her stolen jewels. She was immediately arrested by the revolutionary tribunal, condemned to death and executed. The conflicting estimates of the Du Barry are difficult to reconcile. She was gay, witty, of a frank and pleasing manner and seductive, sensuous beauty. It is doubtful whether her political intrigues had any deeper origin than her desire to please her favorites and gratify her own vanity. It is estimated that her luxuries and her liberality to the arts cost France 35,000,000 livres. The 'Lettres et Anecdotes' ascribed to her are unauthentic. Consult Goncourt, 'La Du Barry' (Paris 1880); Vatel, C., 'Histoire de Mme du Barry d'après ses papiers personnels' (Versailles 1880, containing a bibliography of sources); Douglas, R., 'Life and Times of Mme Du Barry' (London 1896).

DU BARTAS, dü'bär'tä, **Guillaume Salluste,** French poet: b. Montfort, in the department of Gers, 1544; d. Ivry, 14 March 1590. He undertook various diplomatic missions to foreign courts for the Huguenot cause; fought in the Huguenot army and was killed in the battle of Ivry. His fame rests upon two epic poems, the second unfinished, entitled 'La semaine' (The Week) and 'La seconde semaine.' The first, which is far the better of the two, describes the creation of the world; the second the period from the creation to the incarnation of Christ. These poems were very popular in France, and in 1598 Joshua Sylvester translated them into English.

DU BELLAY, Jean, zhŏn dü bĕl'lā, French cardinal and statesman: b. 1492; d. Rome, 16 Feb. 1560. He enjoyed the favor of Francis I, and was sent as ambassador to Henry VIII of England and the Pope, Paul III. He became bishop of Bayonne in 1526, bishop of Paris in 1533 and cardinal in 1535. He was appointed

lieutenant-general of the kingdom during the absence of Francis, who was engaged against the Emperor Charles V in Provence. Falling into disgrace on the death of this king, he retired to Rome. Du Bellay protected and encouraged letters, and it was at his suggestion that the College of France was founded. Rabelais was attached to his establishment.

DUBBS, Joseph Henry, American clergyman: b. North Whitehall, Pa., 5 Oct. 1838; d. 1910. He was graduated at Franklin and Marshall College 1856, and at the Mercersburg Theological Seminary 1859. After several pastorates in the Reformed Church he became in 1875 professor of history and archæology in Franklin and Marshall College. He was a member of various ethnographic and historical societies in the United States, Great Britain and France, and published 'Historic Manual of the Reformed Church' (1885); 'Home Ballads and Metrical Versions' (1888); 'Why am I Reformed?' (1889); 'Leaders of the Reformation' (1900); 'The Reformed Church in Pennsylvania' (1902), etc.

DUBLIN, capital of Ireland (Irish, *Baile athd cliath,* the town of the Ford of the Hurdles; *Dubh-linn,* Black Pool; *Eblana* of Ptolemy), is 60 miles west of Holyhead, 121 miles west of Liverpool and 334½ miles by rail and water from London. Up to 1891 the area was 3,733 acres, and circumference about nine miles. In that year the boundaries were extended. Present area 7,911 acres.

Geology.— The central parts of the city rest upon alluvial soil, and the remainder upon boulder clay. Beneath is the carboniferous limestone plain which so largely occupies the central region of Ireland.

Description.— Dublin is situate on the Liffey (formerly Anna Liffey, from the Irish *Abhainn Liffe*), which divides it into two nearly equal parts, amidst beautiful surroundings. Before it is the broad expanse of Dublin Bay about 10 miles in width, on the left Howth, a high rugged promontory, on the right Bray — a pretty seaside resort — and the Wicklow Mountains, which become a range of undulating hills running down into beautiful fertile plains in the neighborhood of the city. Inland are the level prairie-like stretches which make up the counties of Kildare and Meath. The river divides the city and is spanned by 10 bridges, the most important being O'Connell Bridge, the link between O'Connell street (or Sackville street) — a very wide thoroughfare — and Westmoreland street, College Green and Grafton street. These four streets form the heart of the city.

Public Buildings.— Dublin has many public buildings of architectural and historic interest. The Bank of Ireland, formerly the Parliament House, is a nearly semi-circular structure covering one and one-half acres. Its special feature is a noble Ionic colonnade 147 feet long. It is a good example of the beauty of simple classic severity. The Custom House on the Liffey is a fine granite pile in the Doric order, surmounted by a dome. The Four Courts is a cluster of buildings affording accommodation to the Courts of Chancery, Queen's Bench, Exchequer and Common Pleas. There is a central edifice with a dome ornamented by 24 graceful Corinthian columns, and various other buildings separated by courtyards. The National Library of Ireland and Museum of Science and Art are twin buildings in the style of the 13th century classic renaissance. The other public buildings which deserve mention are the Royal Hospital, Kilmainham, a home for army pensioners; Birmingham Tower, and Chapel of Dublin Castle; Dublin University (q.v.); National Gallery; Mater Misericordiæ Hospital; College of Surgeons; King's Inns; and Royal University buildings.

Monuments.— Nelson's Pillar is a column supporting a statue of Nelson, the whole being 134 feet high. A number of statues are from the chisel of Foley, the most important being those of O'Connell, Grattan, Burke, Goldsmith, Lord Carlyle, Stokes, Sir William Corrigan, Lord Gough, Lord Iveagh and the Prince Consort. There are statues by Sir Thomas Farrell, the most notable those of Sir John Gray, Sir Alexander M'Donald, Smith O'Brien and Barry Sullivan. A statue to Father Mathew, the temperance reformer, occupies a prominent place in O'Connell street. There is also the Wellington Testimonial in Phœnix Park, an obelisk 205 feet high. There are some curious statues of no artistic but great historic interest. The one to King William III is celebrated. Exciting political feeling by being erected in commemoration of the battle of the Boyne, it has at various times been treated with indignity. It has been blown up with gunpowder, pulled down with ropes, and once even tarred and feathered. At the instance of Mr. Sexton, when lord mayor of Dublin, it was painted and surrounded with an iron railing.

Churches.— The largest and most important architecturally is Saint Patrick's Cathedral, a beautiful Gothic structure commenced between 1220 and 1260 on the foundation of an older church of the same name. The design is a Latin cross of graceful proportions. The church consists of nave, choir and transepts — all of which have aisles — and a Lady chapel. Though frequently restored it retains the main features of the original building. Swift, its famous dean, watched over it with great care. Its present excellent condition is due to the late Sir Benjamin Lee Guinness, who in 1864 had it repaired at the cost of £150,000. It is the chief place of Protestant worship in Dublin. Christ Church Cathedral, a beautiful example of early English Gothic passing from the Norman, was founded in 1038 by Sitric, Danish king of Dublin. Time played havoc with the original building, of which the present is but a portion. Between 1181 and 1225 it was remodelled, and the part of the older structure still in existence belongs to this period. Between injudicious restorations and natural decay it had fallen into a wretched state. The great restoration which took place in 1871–78 is due to a public-spirited citizen, Henry Roe. There are many fine modern churches, but none possesses exceptional architectural merit. The Roman Catholic cathedral in Marlborough street is a large building of the Doric order. The Presbyterian church at Rutland square is handsome and ornamented with a fine steeple. The Augustinian church in Thomas street is remarkable for its tower and steeple 160 feet high. In the tower there is a richly carved, lofty arched recess and doorway which has a striking effect. Saint Audoen's

Church, High street, is — after the cathedrals — of most note historically. Saint Mary's, Haddington road; Saint Peter's, Phibsboro; and the small Gothic chapel in Dublin Castle are buildings of merit.

Art and Literary Institutions.— The Picture Gallery in Merrion square contains a good collection of pictures and statuary. It is a state institution and free to visitors. Native art is fostered by the Royal Hibernian Academy, in which there is a yearly exhibition of Irish work. The Museum of Science and Art, a state institution, possesses antiquities illustrating life in early Ireland from the Stone to the Bronze Age. Of special interest are the examples of gold work, the most notable being the Tara Brooch, the Cross of Cong and the cover or shrine of Saint Patrick's Bell. The ornamental work on these is remarkable for delicacy and beauty. The Royal Irish Academy, a literary and scientific society; the Royal Dublin Society, agricultural and scientific; Royal Society of Antiquaries; and Dublin Naturalists' Field Club are important non-academic associations. There is also a society for advancing the study of music, called the Royal Irish Academy of Music.

Libraries.— The following are the principal Dublin libraries, with an approximation of the number of volumes contained in the larger ones: Dublin University Library, 350,000 volumes, many valuable MSS., including the Book of Kells; National Library of Ireland, Royal Irish Academy Library, Marsh's Library and King's Inns Library. There are also small but useful municipal libraries.

Parks.— There are two of size, one, Saint Stephen's Green, being situate in the centre of the city, about one-quarter square mile in area, the other the Phœnix Park (from the Irish *Fionn uisg'*, clear water), on the west side and adjoining the city. The latter is very large and of great natural beauty. It is seven miles in circumference. The valley of the Liffey runs along one side, presenting, with the Dublin Hills in the background, a series of delightful views. In it are the residence of the lord lieutenant of Ireland, the chief secretary to the lord lieutenant, and the under secretary, the Ordnance Survey barracks, Royal Irish Constabulary depôt, Hibernian School for the Sons of Soldiers, Zoological gardens and a number of cricket and football grounds.

Municipal Affairs.— The local government of the city is carried on by the lord mayor, 20 aldermen and 60 councillors; these represent 20 wards. Though the corporation has spent a good deal in providing cheap houses for the poorer citizens, and though private benefactors — notably Lord Iveagh — have also helped, there is still a pressing need for suitable accommodation for artisans and laborers. Apart from the waterworks, the venture which has been attempted is the electric lighting of the city. Historical documents in the archives have been published in 10 volumes, entitled 'The Ancient Records of the City of Dublin.' The city returns four members to Parliament. The first charter was received in 1171, and many since, in all 102.

Education.— Of first importance is Dublin University, with its one College of the Trinity, lodged in a large group of buildings in the heart of the city. Founded in 1591 by Elizabeth, with funds derived from escheated estates, it has always been the chief teaching institution in Ireland and numbers among its students such famous men as Ussher, Swift, Burke, Goldsmith, Emmet, Moore, Lecky. Prior to 1873 the Provostship, Fellowship and Foundation scholarships could be held only by the members of the Protestant communion. The government, subject to Parliament, is in the hands of the provost and senior fellows, acting in conjunction with the visitors. The senate consists of the chancellor and the doctors or masters, who keep their names on the books. The council consists of the provost, or vice-provost, and 16 elected senators.

The Royal University of Ireland, a state institution, is not a teaching body, but examines and confers degrees. Its graduates are mostly students from the Catholic University, a college controlled by the Jesuit Fathers, and from the Queen's colleges of Cork, Belfast and Galway, besides ladies from various conventual and private schools. It is governed by a chancellor, vice-chancellor and a senate of 35 members. Alexandra College, Saint Mary's College and Loreto Convent, Saint Stephen's Green, provide higher education for ladies. The Christian Brothers' schools, the Erasmus Smith schools, Saint Andrew's College, Wesley College, King's Hospital and convent schools are the chief agents for secondary education; the more elementary being supplied by state schools under the Board of National Education, with clergymen as managers. There is a fine municipal technical school, a Royal College of Science and a smaller municipal technical school.

Commerce, Industries and Transit.— Dublin is not a city of great manufacturing activity. Brewing and distilling are its chief industries. The chief brewery is that of Guinness & Co., an immense concern covering over 40 acres. Its capital is £6,000,000, and its yearly output 1,500,000 barrels. Steam barges convey the beer from the brewery, which is situate on a shallow reach of the Liffey, to the vessels in the harbor. There are about 3,300 hands employed. The chief distilleries are John Jameson & Co., and the Dublin Whisky Distillery Co.; both do a large export trade. Jacob & Co., biscuit makers, are an important industry, with a large foreign trade, sending biscuits as far as San Francisco and employing thousands. The manufacture of Irish poplin is still a source of profit and has received an impetus lately from the general desire among Irish people to help native industries. There is a large export trade in provisions and live stock and there are wood and leather manufactures.

The four trunk railways of Ireland meet in Dublin and are connected. Two canals, which traverse the central plain, also terminate here. In tramways the city is well provided, having a most extensive electric overhead haulage system. It is connected by steam packet with Belfast, Glasgow, Liverpool, Holyhead, Bristol, Cork, Plymouth, Southampton, London and Havre. The docks, with the exception of Spencer dock, Ringsend basins and Royal Canal docks, are controlled by the Port and Docks Board. Alexandra Basin has a depth at low water of 24 to 26 feet.

History.— The early history of Dublin is the history of the stranger in Ireland. Before

the close of the 8th century Danish pirates began their raids on the coast, the monasteries, which contained valuable vessels of gold, being their special prey. From the 8th to the 10th centuries they held Dublin, and early records are full of accounts of conflicts with the native Irish. In 1014 King Brian Boroihme ["Boru"] defeated the army of Sitric, the Danish king, at Clontarf, a place now a part of the city. This event seems to have been a severe blow to the prestige of the Danes. The arrival of the Normans in 1169 introduced a new element in Irish history. In 1170 the city was captured by Dermot Macmurrough, a native prince on bad terms with subjects and neighbors. In this he was aided by English allies. Dublin was subsequently attacked by Hasculf, the last of her Danish kings, and his defeat and death put an end to their dominion. From this time the city remained the stronghold of the English settlers; the decayed castles studded over the counties Dublin, Kildare and Meath bear silent witness that the occupation was not a peaceful one. From Plantagenet to Stuart, history tells of innumerable battles and skirmishes between the inhabitants of Dublin and the septs of the Wicklow Mountains, the O'Byrnes, O'Tooles, Kavanaghs and others. How strenuous the life of a citizen must have been is evidenced by frequent record, such as — "The Mayor and light-armed citizens marched out against the O'Tooles and were forced to retreat." At the Reformation most of the English in Dublin conformed, though the descendants of the Norman settlers in other parts of Ireland, merged in the native races, adhered to the old faith. This intensified the hatred between the English in Dublin and their Celtic neighbors. The success of the military operations at the end of Queen Elizabeth's reign followed by the extensive confiscation, and the plantation of Scotch and English settlers, which beginning with Elizabeth was continued by James I and Charles I, helped to make the citizens more secure. The failure of the insurrection of 1641 and the subsequent war increased this security. Till the Commonwealth Dublin remained a walled town with little change of appearance, but with the Restoration began its evolution from a mediæval to a modern metropolis. After the Williamite wars the native Irish who remained in the country were without property or civil rights and sank into apathy and general wretchedness. This state of things, as it ensured peace, favored the growth of the city, and in the 18th century Dublin, as we now know it, grew. To this period belongs a spell of commercial activity which, however, owing to hostile legislation of the English Parliament at the instance of English manufacturers, did not continue. Before the union with England the Irish capital was a city of first importance, not only as a commercial centre, but also as a place of literary and dramatic activities — producing its own plays and its own operas. The union had a disastrous effect, the wealthy residential classes following the Parliament to London. The abortive insurrections of 1798 and 1803 are indicative of the national unrest of the time. The history of Dublin in the earlier 19th century seems to be a record of continued decline. Thackeray, who paid it a visit in 1842, says — "A handsome town, with fewer inhabitants, it is impossible to see on a summer day." In 1847 occurred the attempted rising headed by John Mitchell and others, and in 1867 another resort to arms took place.

It is risky to generalize upon the composite population of a capital, but Dublin people may be fairly described as good-humored, unenthusiastic and not very energetic. Political or religious acerbities do not interfere with social harmony. Wages in general among the laboring class are small, and there is much poverty of a depressing kind. Within recent years there has been a marked revival in library matters, and — apart from the Gaelic League — a school of new writers has arisen whose aspirations are of Ireland and for Ireland. The Gaelic League, a powerful organization, whose objects are the revival of the Irish language and the study of Irish history, and many of the members of which were deeply implicated in the rebellion of 1916, has its headquarters in the city. Pop. (1901) 290,638; (1911) 304,802, of whom 83 per cent are Roman Catholics.

The Revolt of 1916.— Coincident with the attempt of Sir Roger Casement (q.v.), with German assistance, to land arms and ammunition in the west of Ireland, a serious revolt broke out in the capital, and in some other parts of the country. It was organized by the Sinn Feiners, the ultra-radical, physical-force nationalist organization, and was begun on Easter Monday, 24 April 1916. A large body of rebels seized Saint Stephen's Green. The post-office was captured; telegraph and telephone wires were cut; and houses in different parts of the city occupied by the insurgents. An Irish republic was proclaimed, and a provisional government appointed. An attack on Dublin Castle was repulsed. The authorities, while cognizant of collusion between the German government and the Sinn Feiners and apprehensive of armed revolt, were taken unawares by the suddenness of the outbreak; military law was proclaimed, all available troops were hurried from the Curragh Camp, and the work of attempting to reoccupy the parts of the city taken by the rebels began. On the day following the outbreak a gunboat on the Liffey shelled Liberty Hall, the headquarters of the rebels, and cavalry charged them in Sackville street. Severe fighting, great loss of life among soldiers, rebels and peaceful citizens alike, and many destructive fires ensued; but on May 1 the revolt terminated with the surrender of Provisional President Pearse who at the same time advised the insurgents to lay down arms. In addition to this 1,000 arrests were made. The casualties among the military were 127 killed and 352 wounded, and among the non-military population there were 1,930 casualties, with 200 killed. The end of the revolt was followed by a visit to Dublin of Premier Asquith, and by an abortive attempt to settle by consent the Irish Home Rule controversy. For details of the rebellion, see IRELAND.

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DUBLIN, University of. The first University of Dublin was founded in 1320 in connection with Saint Patrick's Cathedral. Having no endowment, and owing to changes in government and religion throughout the country, the university gradually declined, until it ceased to exist in the reign of Elizabeth. The present university was founded in 1591, when a charter, or letters patent, was granted by Queen Elizabeth for the incorporation of the "College of the Holy and Undivided Trinity." This college is stated in the charter to be incorporated as the "mother of an university," whence it appears that it was intended to be only the first of a number of colleges to be afterward established in connection with the same university, the senate of which is incorporated by a charter distinct from that of Trinity College. Up to this time, however, no other such colleges have been established, so that Trinity College alone still enjoys the rights of the university. Although Elizabeth promised much, little was done by the Crown for the support of the institution. The suppressed monastery of All Hallows was given to the new university and a fund was raised among the Irish nobles. Under James I more aid in money and lands was given to the school. In 1637 changes were made in the constitution of the university.

The members of the corporation consist of a provost, 7 senior fellows, 27 junior fellows and 70 foundation scholars. The management of the college is entrusted to the provost and senior fellows in conjunction with the visitors and the council, the last named body consisting of the provost, four senior fellows, four junior fellows, four professors who are not fellows and four other members of the senate. The senate of the university, as incorporated by royal charter, consists of "the chancellor of the university, or, in his absence, of the vice-chancellor, and such doctors or masters of the university as shall have and keep their names on the books of Trinity College." The senate possesses, under prescribed conditions, the right of electing the chancellor of the university. It is also the body which grants degrees, subject to the sanction of the college board and of the caput of the senate. This latter body consists of the chancellor or vice-chancellor, provost (or vice-provost), and the senior master non-regent, and every member of the caput has the right of refusing a degree by a veto. The fellows are appointed for life. The senior fellows are promoted from the number of the junior fellows in order of seniority, and every vacancy among the junior fellows is filled up by the provost and senior fellows after a strict examination for 12 days in mathematics, pure and applied, experimental sciences, classics, with Hebrew and cognate languages, and mental and moral science. The scholars are chosen from among the undergraduates, after an examination in pure and applied mathematics and logic or experimental science, or in Greek, Latin and English composition. Non-foundation scholars are not members of the corporation of the college. Scholars receive an annual salary of £20, have their commons free of expense, and their rooms for half the charge paid by other students. They hold their scholarships until the end of the June quarter of the fifth year following their election, or following the time at which they become or might have become masters of arts, whichever period terminates first. Students, before being admitted, must submit to an examination in Greek, Latin, arithmetic, English composition, history and geography. Students may enter as belonging to one of four classes. The first consists of noblemen, noblemen's sons and baronets. The second consists of the fellow-commoners (who dine at the fellows' table). The third and most important is the class of pensioners, forming the great body of the students; and the fourth is the sizars, who are partially maintained out of the college funds and are now admitted by competitive examination. These last are limited to 30 in number. The academical year is divided into three terms—Hilary, Trinity and Michaelmas term. To obtain the B.A. degree the student must keep eight terms in all, covering normally four academic years. Terms are kept during the undergraduate course, either by lectures or by examinations, but terms in divinity, law, medicine and engineering must be kept by attendance on the lectures of the professors. The system of instruction is superintended by the fellows, together with a large staff of professors. Several of the junior fellows act as tutors, and every student must place himself under one of these on entering the college. The tutors during term deliver lectures on the subjects necessary to a degree. These are: In the first year, mathematics, Greek, Latin, English composition; in the second year, mathematics, mathematical physics, logic, Greek, Latin, English composition; in the third year logic, mathematical physics, English composition, Greek, Latin, experimental and natural science, astronomy, history, French, German; and in the fourth, astronomy, ethics, English composition, logic, mathematical physics, languages, experimental and natural science, history and political science. During the first academic year a student is called a junior freshman; during the second, a senior freshman; during the third, a junior sophister; and during the fourth, a senior sophister. Students who have successfully passed all the necessary examinations in the course given above have the degree of B.A. conferred on them by grace of the senate in full congregation. Those who wish to obtain honors must pass through a more extended course of study. Honors are attainable in seven departments: 1, mathematics and mathematical physics; 2, classics; 3, logic and ethics; 4, experimental science; 5, natural science; 6, history and political science; 7, modern literature. Those who successfully pass the examinations in any of these departments are classed according to merit as senior or junior moderators and respondents. Noblemen and noblemen's sons are entitled to have the degree of B.A. conferred on them *per specialem gratiam;* and fellow-commoners are entitled to receive it with one term-examination

less than pensioners. The degrees are conferred on commencement days, of which there are four in each year. There are divinity, law, medical and engineering schools in connection with the university, and degrees or licenses in each of these branches are granted by the university senate on the completion of the prescribed courses. The degrees of D.Sc. and Litt.D. are conferred on B.A.'s who have attained scientific or literary distinction. The degrees of bachelor and doctor in music are also conferred.

The college possesses a fine library of about 350,000 printed volumes and 1,700 manuscripts. It has also a well-stocked botanic garden and museum. The observatory, five miles distant at Dunsink, is the official residence in Ireland of the royal astronomer. In 1613 James I granted to the university the right of returning two members of Parliament. One was taken away at the Union, but was restored by the reform bill of 1832. The parliamentary constituency consists of the provost, fellows and foundation scholars, ex-fellows and ex-foundation scholars, masters of arts, surgery and engineering, and graduates holding all higher degrees.

DUBOC, dü-bōk, **Julius,** German author: b. Hamburg, 10 Oct. 1829; d. June 1903. He studied at Giessen, Leipzig and Berlin, and wrote much for the leading liberal periodicals, especially the *National Zeitung.* He published 'Geschichte der Englischen Presse' (1873); 'Die Psychologie der Liebe' (1874); 'Das Leben ohne Gott' (1875); 'Gegen den Strom' (1877); a collection of his earlier essays, 'Der Optimismus als Weltanschauung' (1881); 'Jenseits von Wirklichen' (1896); and 'Fünfzig Jahre Frauenfrage in Deutschland,' a collection of essays on the woman question.

DU BOIS, dü-bois', **Constance Goddard,** American author: b. Zanesville, Ohio. She has been an active supporter of efforts to improve the condition of the Mission Indians of southern California. She has published 'Martha Corey: a Tale of the Salem Witchcraft' (1890); 'Columbus and Beatriz' (1892); 'A Modern Pagan' (1895); 'The Shield of the Fleur-de-Lys' (1895); 'A Soul in Bronze' (1900); 'Religion of the Luiseño Indians of Southern California' (1908).

DU BOIS, William Edward Burghardt, American educator: b. Great Barrington, Mass., 23 Feb. 1868, of negro descent. He was graduated at Fisk University 1888 and at Harvard 1890, subsequently studying at the University of Berlin. He has been a Fellow of Harvard, assistant in sociology at the University of Pennsylvania, professor of economics and history in Atlanta University, and since 1910 editor of *The Crisis Magazine,* New York. He has published 'The Suppression of the African Slave Trade to the United States, 1638–1870' (1896); 'The Philadelphia Negro' (1899); 'Souls of Black Folk' (1903); 'John Brown' (1909); 'Quest of the Silver Fleece' (1911); 'The Negro' (1915); editor of the Atlanta University 'Studies of the Negro Problem' (15 monographs, 1896–1915).

DU BOIS-REYMOND, bwä-rā-môn, **Emil,** German physiologist: b. Berlin, 7 Nov. 1818; d. there, 26 Dec. 1896. He studied theology, geology and subsequently anatomy and physiology at Berlin under Johann Müller. At the age of 22 he began those researches in animal electricity which occupied him for nearly 40 years. His first experiments were published in 'Untersuchungen über tierische Elektrizität' (2 vols., 1848–49). His instruments were of his own invention, and with them he succeeded in demonstrating the electrical phenomena occurring in muscular activity and in nervous activity, and established the law now bearing his name: that it is the variation of a current density and not the absolute value of current density at any given moment that acts as a stimulus to a muscle or motor nerve. He succeeded Müller as professor of physiology in the University of Berlin in 1858. In 1867 he became permanent secretary of the Berlin Academy of Sciences and later was appointed imperial privy councillor. He also performed successful experiments proving that muscular reaction at rest is neutral or slightly alkaline and acid after death, and that acid is produced in the act of contraction. His investigations include important research on the aperiodic state of the magnetic needle induced by high dampening powers. He also invented the method of reading messages over the Atlantic cable by watching the beam of light reflected from a mirror attached to the needle of a galvanometer. His reputation as a scientist is world-wide, and his researches form the basis of all further information on animal electricity. His other publications include 'Über die Grenzen des Naturkennens' (6th ed., 1884); 'Gesammelte Abhandlungen zur allgemeinen Muskel-und Nervenphysik' (2 vols., 1875–77); 'Reden' (2 vols., 1886–87); and 'Vorlesungen über die Physik des organischen Stoffwechsels' (1899). Consult Engelmann, 'Gedächtnisrede auf Emil Du Bois-Reymond' (Berlin 1898).

DUBOIS, dü'bois', **Augustus Jay,** American engineer: b. Newton Falls, Ohio, 25 April 1849; d. 19 Oct. 1915. He was graduated at Sheffield Scientific School in 1869; in 1874 was appointed professor of civil engineering at Lehigh University, and in 1876 professor of mechanical engineering at Sheffield Scientific School. After 1884 he was professor of civil engineering at the last institution. He has published 'Elements of Graphical Statics' (1876); 'The New Method of Graphical Statics' (1876); 'Strains in Framed Structures' (1883; 11th ed., 1900); 'Elements of Mechanics' (1893–95).

DUBOIS, dü-bwä, **Clément François Théodore,** French musical composer: b. Rosnay (Marne) 1847. He studied at the Paris Conservatory and won the Prix de Rome in 1861. He was organist at the church of the Madeleine, professor of harmony, then professor of composition at the Conservatory and finally became director of that institution. The Legion of Honor and many other foreign orders were conferred on him. His compositions for the organ were very well received, his popularity as an organist greatly enhancing their favor. In 1894 he became a member of the Academy of Fine Arts. His compositions include the cantata, 'Atala'; the operas, 'Aben Hamet'; 'Xaviere' and 'Circe'; the oratorios, 'The Seven Words of Christ,' and 'Paradise Lost'; 'The Baptism of Clovis,' and a number of organ pieces, masses, etc.

DUBOIS, Edmond Paulin, French hydrographer: b. Brest, 12 July 1822; d. there, 11 Nov. 1891. He made voyages in the Indian Ocean and along the west coast of Africa, and in 1851 was made professor of the Ecole Navale in Brest. He invented a compass with a double needle to determine the variation due to the ship's ironwork, and wrote 'Cours d'astronomie' (1858); 'Etude historique et philosophique sur le mouvement du globe' (1861); 'Les passages de Vénus sur le disque solaire' (1883); 'Cercle nautique' (1888), and edited the 'Ephémérides astronomiques.'

DUBOIS, Guillaume, French cardinal and statesman: b. Brives-le-Gaillard, Corrèze, France, 6 Sept. 1656; d. Versailles, 10 Aug. 1723. He became tutor of the Duke of Chartres, afterward Duke of Orleans, and when in 1715 the duke was declared regent Dubois was appointed by the duke councillor of state. He succeeded in overcoming the dislike of George I of England to the person of the regent, and in 1717 concluded the triple alliance between England, France and Holland. He was rewarded by the Ministry of Foreign Affairs and began to aspire to the highest dignities of the Church. The archbishopric of Cambrai having become vacant, Dubois ventured to request it of the regent, although he was not even a priest. As the king of England united with Dubois in his request, he obtained it and in one morning received all the orders and a few days after the archbishopric. By his consummate address he obtained a cardinal's hat and in 1721 was appointed Prime Minister. Consult 'Le régent, l'abbé Dubois et les Anglais' (Paris 1891).

DUBOIS, Jean Antoine, French abbé and missionary: b. Saint-Remèze, department of Ardèche, 1765; d. Paris, 7 Feb. 1848. He spent 32 years in the East Indies, and on his return published 'Letters on the State of Christianity in India' (1823), which produced much controversy in England from the fact of his having frankly expressed therein his disbelief in the possibility of the conversion of the Hindus. He wrote several works relating to the religion and the traditions of India and many contributions to the *Bulletin des sciences* and to the journals of the Asiatic societies of London and Paris. His most celebrated work on India was purchased by the East India Company, published at its expense in London in 1816 and afterward published in French under the title of 'Mœurs, institutions, et cérémonies des peuples de l'Inde' (1825).

DUBOIS, John, American Roman Catholic bishop: b. Paris, 24 Aug. 1764; d. 20 Dec. 1842. As student in the College Louis le Grand he had as fellow students Camille Desmoulins and Robespierre. In 1781 he was ordained priest. With several thousand other ecclesiastics he was forced to flee from France in the Revolution and came to the United States in 1791. His first charge in this country was at Norfolk, Va., whence he was transferred to Richmond; there he was for a time a guest in the house of James Monroe and was the friend of prominent citizens, Patrick Henry undertaking his instruction in the English language. From Richmond he was transferred to Frederick, Md., the only priest then stationed between Baltimore and Saint Louis. In 1809 he founded Mount Saint Mary's College near Emmittsburg, Md., and was its first president, occupying at the same time two or three professorships. In addition he assumed the duties of chaplain and director of the house of the Sisters of Charity, then founded by Mrs. Seaton in the neighborhood of Emmittsburg. He was subsequently appointed bishop of New York, the diocese including that State and New Jersey, with a Catholic population of 150,000 souls, eight church buildings and 18 priests. Owing to old age and increasing infirmities in 1838 he obtained a coadjutor in the person of John Hughes, who became his successor.

DUBOIS, Louis, Belgian painter: b. Brussels 1830; d. there, 28 April 1880. He was one of the most prominent painters of the realistic school and worked equally well as a painter of portraits, marines, still life and landscapes. Among his works are 'The Rice Eater'; 'The Meuse'; 'Priests Preparing for Mass,' and 'The Billiard Player.'

DUBOIS, Paul, French sculptor: b. Nogent-sur-Seine, 18 July 1829; d. Paris, 23 May 1905. In 1837 he entered the College Louis le Grand and later took up the study of law, which he followed until his 27th year, when he became a pupil of Toussaint. In 1863 he exhibited 'Narcissus at the Bath,' now in the Luxembourg, and in 1864 a bronze of 'John the Baptist' as a young man. 'The Florentine Minstrel,' which won the medal in 1865, is also in the Luxembourg. Among his other productions are a successful statue of 'Joan of Arc' (in Rheims 1889); 'Alsace and Lorraine' (1900) and portrait busts of Pasteur, Baudry, Gounod and others. The most elaborate of his sculptures was a tomb in Nantes Cathedral, decorated with many statues and bas-reliefs. He was also a painter. He was made an officer of the Legion of Honor in 1867 and became grand officer in 1889. He was a director of the Luxembourg and also of the National School of Fine Arts.

DUBOIS, Pa., borough in Clearfield County, situated on the Buffalo, Rochester and Pittsburgh and the Pennsylvania railroads, about 80 miles northeast of Pittsburgh. It is in a coal mining region, and a large amount of mining and agricultural implements are manufactured. There are also glass and clay works, blast furnaces, large railroad repair shops, machine shops, a foundry, a tannery, an ice-cream factory, etc. The United States census of manufactures for 1914 showed within the borough 34 establishments of factory grade, employing 1,281 persons, of whom 1,105 were wage-earners, receiving annually $686,000 in wages. The capital invested aggregated $3,296,000, and the year's output was valued at $2,395,000: of this, $1,150,000 was the value added by manufacture. The borough contains a general hospital and owns its waterworks. Settled in 1873, Dubois was incorporated as a borough in 1881. Pop. 14,007.

DU BOSE, dė bōz', **William Porcher,** American theologian: b. Winnsboro, S. C., 11 April 1836; d. 1918. He was graduated at the South Carolina Military Academy; then received his A.M. at the University of Virginia (1859), and his theological education at the Theological Seminary of South Carolina. He

was chaplain of Kershaw's brigade in the Confederate army during the Civil War (1861–65). In 1864 he was ordained deacon and in 1865 priest of the Protestant Episcopal Church. From 1866–67, he was rector of Saint John's, Winnsboro, and from 1868–71 of Trinity Church, Abbeville, S. C. He became chaplain and professor of ethics and New and Old Testament languages and interpretation at the University of the South in 1894, serving as dean of the theological department from 1894–1908, when he became dean emeritus. He holds the Adoptionist theory of the purpose of Christ's life. He is the author of 'The Soteriology of the New Testament' (1892); 'The Ecumenical Councils' (1896); 'The Gospel in the Gospels' (1906); 'The Gospel According to St. Paul' (1907); 'High Priesthood and Sacrifice' (1908); 'The Reason of Life' (1910); 'Turning Points in My Life' (1912).

DUBOST, Antonin, French politician: b. Arbresle, Rhône, 1844. He was a contributor for some time of *La Marseillaise*, and became successively secretary-general of the prefecture of police in 1870, prefect of Orne in 1871, councillor of state in 1879, president of the general council of Isère in 1893 and Minister of Justice in the Casimir-Perier Cabinet in 1893–94. He became a senator in 1897 and was elected president of that body in 1906. He was energetic in pointing out the effect on the school children of the country of the teaching of the religious orders, who were in the main opposed to the Republic. He is the author of 'Les suspects en 1858' (1867); 'Les conditions du gouvernement en France' (1879); 'Danton et la politique contemporaine' (1880); 'Danton et les massacres de septembre' (1885).

DUBOVKA, doo-bŏf'kā, Russia, city in the government of Saratov, on the Volga. The commercial importance of Dubovka has declined considerably, owing to the fact that the railway line from Kalach on the Don connects with Tzaritzin on the Volga. It was once an important centre for trade in farm products. Pop. 16,900.

DUBUFE, dü'büf', **Edouard,** French painter: b. Paris, 30 March 1820; d. Versailles, 10 Aug. 1883. He was a pupil of his father, Claude Marie Dubufe, and of Delaroche. Among his works are portraits of the Empress Eugenie, Rosa Bonheur, Gounod, the younger Dumas and Emile Augier; also a number of religious paintings, including 'The Prodigal Son.' In 1853 he became Chevalier of the Legion of Honor. The Salon of 1844 awarded him a first-class medal.

DUBUFE, Edouard Marie Guillaume, French painter: b. Paris, 16 March 1853. He is a son of Edouard Dubufe (q.v.). Among his paintings are 'St. Cecilia'; 'Music, Sacred and Profane'; 'Autumn'; 'The Flight into Egypt'; and several portraits. He has also decorated the Hôtel de Ville in Paris and the Salle des Fêtes de l'Elysée.

DUBUQUE, doo-būk', Iowa, city, port of entry, county-seat of Dubuque County, on the Mississippi River, the Burlington, the Chicago Great Western, the Chicago, Milwaukee and Saint Paul and the Illinois Central and other railroads, 167 miles northwest of Chicago. It has steamer communication with the leading ports on the Mississippi and is connected with the opposite shore of the river by three bridges. It has communication by boat with other points on the river. The city is built partly on a terrace, 20 feet above the river, and partly on the bluffs, which rise 200 feet high. The lower or business portion is regularly laid out and compactly built, and in the upper portion the streets rise picturesquely one above another. Among the prominent buildings are the United States government buildings, the Central Market, the Carnegie-Stout library, Saint Raphael's Cathedral (R.C.) and several other important churches. The city is the centre of the lead and zinc region of Iowa, northwestern Illinois and southwestern Wisconsin, and contains large zinc works. In 1914 there were 139 establishments in operation, with a combined capital of $13,329,000, employing 6,109 persons, paying $3,851,000 for salaries and wages, and yielding products aggregating in value $14,714,000, made from raw materials valued at $8,188,000. It is also an important market for the agricultural produce of the district. The principal manufactures were packed meat, lumber, foundry and machine shop products, malt liquors, bread and bakery products, carriages and wagons, flour, boots and shoes, agricultural implements, leather, furniture, toys, notions, bricks, oils, engines, steel ship hulls, barrels, brooms, buttons, sashes, doors, millinery and clothing. The national banks have a combined capital and surplus of over $1,000,000. There are State, savings and private banks. The city is the winter harbor for boats on the upper Mississippi. In 1893 it was created the see for an archdiocese of the Roman Catholic Church. It is lighted with electricity, has an extensive waterworks system, public library, several hospitals and asylums, electric street railways and an inclined cable road leading from the river level to the bluffs. Gunboats for the United States navy have been built here.

There are over 4,500 pupils enrolled in the public day schools; about 140 teachers; and public school property valued at $500,000. There are over 3,500 pupils enrolled in the private and parish schools. For higher instruction there are a public high school, the academies of Saint Joseph, Saint Mary, Saint Vincent and the Visitation, Wartburg Seminary (Lutheran), the German Presbyterian Theological School of the Northwest and the State Institute of Arts and Sciences.

The city was named in honor of Julien Dubuque, a French trader, who with 10 others settled here in 1788 to mine lead. This was the first settlement in what is now the State of Iowa. The settlement was abandoned after Dubuque's death in 1810, and the site was not again occupied till 1833. This last was the first permanent settlement in Iowa. In 1839 it was incorporated as a town, and in 1840 received its charter as a city. Pop. 39,428.

DUC, dük, **Joseph Louis,** French architect: b. Paris, 25 Oct. 1802; d. 22 Jan. 1879. Winning the Prix de Rome in his 23d year, in 1840 he was chosen to assist in designing the monument in the Place de la Bastile. His chief work is the Palais de Justice in Paris, which occupied the greater part of 25 years in building, for which the Emperor Napoleon III gave him $20,000 as a special prize. The architect

devoted the greater part of this sum to establish a prize for excellence in architecture. (For a description of the Palace of Justice see PARIS). In 1866 he became a member of the Institute and in 1871 inspector-general of all civic buildings.

DU CAMP, dü kăn', **Maxime,** French writer: b. Paris, 8 Feb. 1822; d. Baden-Baden, 8 Feb. 1894. He wrote the history of the Paris Commune: 'The Convulsions of Paris' (1878–79), and other historical sketches: 'Egypt, Nubia, Palestina and Syria' (1852); but his greatest work is 'Paris: Its Organs, its Functions, and its Life' (1869–75). He likewise wrote some lyric poems: 'Modern Chants' (1855); 'Convictions' (1858); and several novels, among them 'Memoirs of a Suicide' (1853); 'The Six Adventures' (1857); 'The Man with the Gold Bracelet' (1862).

DU CANGE, dü-kānzh', or **DUCANGE,** SIEUR **Charles du Fresne,** or **Dufresne,** French historian and philologist: b. Amiens, 18 Dec. 1620; d. Paris, 23 Oct. 1688. His family name was Dufresne, and Sieur Ducange was his title as lord of his paternal estates. He was an alumnus of the college of the Jesuits in his native town and after completing his studies there took up the study of jurisprudence, and in 1631 was admitted to practise as an advocate at the bar of the Parliament of Paris. Meeting with discouragement in his profession, he withdrew to to his native place and there devoted himself to the historical, linguistic and philological studies which have made him illustrious as a scholar. He was indefatigable in research, and his linguistic attainments, critical acumen and various knowledge enabled him to digest and sort out of the infinite mass of material the facts of history and the points of philology which were necessary for the composition of the many solid memoirs of which he is author. And those works involved titanic labor even if we consider only the work of the pen in making «copy» for the printer; for every word was penned with his own hand. Of the long list of his printed works the two which are most enduringly important—and frequent reference to these is imperative on whosoever studied the history of the Middle Ages at its sources—are his dictionaries of the Greek and Latin languages in the period of their decline. Among other writings may be named 'Histoire de l'empire de Constantinople sous les empereurs français'; 'Historia byzantina duplici commentario illustrata'; 'Chronicon Paschale a mundo condito ad Heraclii imperatoris annum vigesimum.' Consult Sandys, 'A History of Classical Scholarship' (Vol. II, Cambridge 1908).

DUCAS, doo-käs, **Michael,** Byzantine historian of the 15th century. He was a descendant from an imperial family, and himself held a high position at the court of Constantine Palæologus, the last emperor of Constantinople. After the conquest of that city by Mohammed II he took refuge with the Prince of Lesbos, Dorino Gateluzzi, and his prudence and skill succeeded in saving the independence of Lesbos for a time. It is probable that he wrote in his old age the history of the Byzantine empire. This begins with an outline of universal chronology, and does not become detailed and truly instructive till the reign of John Palæologus I, and it terminates abruptly in the middle of a sentence, at the capture of Lesbos in 1462. It is the most difficult of all the Byzantine histories, written in a barbarous style, but is judicious and impartial.

DUCAT, the name of certain gold or silver coins current in several countries, but is no longer the monetary unit in any country. It had its origin in 1140, and was formerly a favorite coin with the Dutch, and, owing to the excellence of the pieces struck, they were sought for and imitated by several other countries, and especially Russia. Ducats now everywhere circulate at a valuation, where they circulate at all, or are bought and sold simply as bullion. The following are some of the best known:

1. The gold ducat of Holland, weighing 3.494 grammes, .983 fine, value about $2.33. 2. The gold ducat of Russia, which is of precisely the same weight, fineness and value as the Dutch ducat. 3. The gold ducat of Austria-Hungary, weighing 3.4904 grammes, .986 fine, value $2.34. 4. The gold ducat of Sweden, weighing 3.486 grammes, .9766 fine, value $2.31. 5. The gold ducat of Hamburg, valued at $1.85. 6. The silver ducat of Sicily, weight 22.943 grammes, .833 fine, value 84 cents.

DUCATO, Cape. See CAPE DUCATO.

DUCATOON, dŭk-ą-toon', or **DUCASTONE,** formerly a Dutch silver coin worth 3 gulden 3 stivers, or $1.30. There were coins of the same name in Italy. In Tuscany its value was about $1.35, in Savoy slightly more, and in Venice about 97 cents.

DUCCIO DI BONINSEGNA, dŭch'ō dē bōn-ēn-sān'yä, Italian painter, founder of the Sienese school: b. Siena about 1260; d. about 1320. He was doubtless trained at Byzantium or came into contact with a Byzantine teacher, as his skill in decoration indicates. In 1285 he was at Florence where he contracted to paint an altar-piece of the Madonna for the Santa Maria Novella. In 1298 he served as a member of the official board of the council of Siena. In 1301 he began a 'Majesty' for the chapel of the Public Palace there of which no record remains. His great work is the altar-piece of the cathedral in Siena, which when completed was carried in a procession to the cathedral. It shows the Madonna surrounded by saints and angels; on the reverse are 26 pictures of the Passion of Christ. Some of these are now in the galleries of the Berlin Museum, the Benson collection and the National Museum, London. Two other Madonnas at the Siena Academy are also attributed to him; likewise a 'Crucifixion' in the possession of the queen of England, a 'Madonna with Angels, Prophets and Saints' (National Gallery, London); the 'Preaching of St. John the Baptist' and 'Saints Peter and Paul' (Rambona Collection, Cologne). Of doubtful authenticity is the triptych of the 'Crucifixion' in the J. P. Morgan collection, New York. It is as an illustrator that Duccio excels. His groupings and arrangement are admirable, his perspective good and his drawing graceful and careful. But, despite his excellent dramatic sense and his imaginative force, he failed to inspire his figures with a sense of reality. They lack

weight, mass, solidity. Their movements are empty attitudes. There is no breath in the beautiful figures that fill his canvasses. Duccio was not an innovator. He perfected the models and types of the old school. His colors are rich and harmonious and he shows an understanding of the handling of light and shadow. His principal pupil and follower was Simone Martini. Consult Berenson, 'The Central Italian Painters of the Renaissance' (2d ed., London 1909); Wulff, 'Repertorium für Kunstgeschichte' (1907); Crowe and Cavalcaselle, 'History of Painting in Italy' (ed. by Langton Douglas and S. A. Strong, London 1911).

DU CHAILLU, Paul Belloni, dü shä-yü', American traveler: b. Paris, 31 July 1835; d. Saint Petersburg, Russia, 30 April 1903. He spent his youth in the French settlement on the Gaboon, on the west coast of Africa, where his father was a merchant, and received his education from the Jesuits there. In 1852 he went to the United States, of which he afterward became a naturalized citizen. In 1855 he began his first journey through western Africa, and spent till 1859 alone among the different tribes, traveling on foot upward of 8,000 miles. He collected several gorillas, never before hunted, and rarely, if ever, before seen by any European. The result of this journey was his work 'Explorations and Adventures in Equatorial Africa' (1861). This book contained much important information on the zoology, geography and ethnology of parts of the continent then unknown to Europeans, and by many authorities Du Chaillu's statements were received with suspicion; but subsequent expeditions by others fully confirmed his substantial accuracy. A second expedition was made by him in 1863, an account of which, under the title 'A Journey to Ashango Land,' appeared in 1867. 'The Land of the Midnight Sun,' an account of a tour in northern Europe (1881), had a considerable success. He has also published a number of books intended for youth, and based on his travels. One of his later works is 'The Viking Age' (1889), a treatise on the ancestors of the English-speaking peoples. In addition to the works named above may be mentioned his 'Stories of the Gorilla Country' (1868); 'Wild Life Under the Equator' (1869); 'Lost in the Jungle' (1869); 'The Country of the Dwarfs' (1872); 'The Land of the Long Night' (1899); 'The World of the Great Forest' (1900); 'How Animals, Birds, Reptiles and Insects Talk, Think, Work and Live' (1900).

DUCHÂTEL, Charles Marie Tanneguy, COUNT, French economist and politician: b. Paris, 19 Feb. 1803; d. there, 6 Nov. 1867. Prior to 1830 he took an active part in editing the *Globe,* one of the leading organs of the Liberalists. He began his parliamentary career in 1832, was named secretary-general of the finances in 1833, and in 1835 was appointed to the Ministry of Commerce. He resigned with his colleagues in February 1836, and now became one of the most energetic leaders of the opposition. At the accession of the cabinet of Soult and Guizot in 1840 he came again into power as Minister of the Interior, and retained this position with but a short interruption till the revolution of 1848, after which he lived in retirement. The measures supported by him both as deputy and minister were generally of a financial character, but he also took a prominent part in the establishment of railways and telegraphs in France. He wrote several works on economics.

DUCHESNE, dü-shān', **André,** French historian: b. Touraine, Isle Bouchard, May 1584; d. 30 May 1640. History and geography were his favorite studies from his youth, and under Richelieu's ministry he was appointed royal geographer and historiographer. His most important works are 'Histoire d'Angleterre, d'Écosse et d'Irelande' (1614); 'Histoire des Papes jusqu'à Paul V' (1616); 'Histoire des rois, ducs, et comtes de Bourgogne' (1619–28), and his collections of the early Norman and French histories. His industry was extraordinary; he is said to have left more than 100 folios in manuscript. He is frequently styled "The father of French History."

DUCHESNE, Jacques Charles René Achille, French soldier: b. Sens 1837. He fought in the Franco-Prussian War of 1870–71, in which he gained distinction. He added to his fame in the Tongkin in 1883, was made brigadier-general in 1888 and a general of division in 1893. In 1895 he was commandant of the expedition sent out to conquer Madagascar, of which his official 'Rapport' (Paris 1897) is the best account. In 1900 Duchesne was appointed member of the Superior Council of War.

DUCHESNE, Louis Marie Olivier, French Roman Catholic Church historian: b. Saint Servan, France, 13 Sept. 1843. He was educated in Paris and Rome. From 1877 to 1895 he was professor of Church history and since 1895 director of the French School at Rome. His most notworthy contributions to Church history have largely been produced as the result of his researches into the early history of the Christian Church. The best known in English are 'Christian Worship; its Origin and Evolution' (1902; 3d ed., 1910); 'Early History of the Christian Church from its Foundation to the End of the Third Century' (translated from the 4th ed., 2 vols., New York 1913). He edited 'Liber Pontificalis' with introduction and commentary (2 vols., 1896–98). Some years earlier he published the results of his study of these documents.

DUCHESS, The, the pen-name of MARGARET WOLFE HUNGERFORD (q.v.).

DUCHESS OF DEVONSHIRE, English noblewoman, made famous by two beautiful portraits, one by Reynolds and the other by Gainsborough. The latter, the more famous of the two, shows the lady wearing a broad trimmed hat with plumes that has come to be known as the Gainsborough hat. The picture is in the gallery of the New British Institution, replaced in 1902 after having been concealed since 1876, when it was cut from the frame by a noted American thief since dead.

DUCHESS OF MALFI, The. One of the mysteries of English theatrical history is the oblivion in which Webster's tragedy rested until it was resurrected by Lamb. The purest tragedy in English literature outside of Shakespeare it possesses the best characteristics of

that writer's free and elevated imagination. Distinctly a play of "school," by this meaning that it belonged to the revenge and blood type, it imbued the type with a veritable psychology that raises it above the class. Webster is today remembered only for his two tragedies, 'The White Devil' and 'The Duchess of Malfi.' The latter play, written between 1609 and 1614, was taken from a novel by Bandello in the second volume of Paynter's 'Palace of Pleasure.' The play adds to a full catalogue of the elements of horror — tragedy, dark scenes, dead hands, dancing madmen and dumb-shows — other qualities of a higher order. These are clarity of purpose in the handling of the plot, beauty of verse and an insight into character amounting to revelation.

Basola, the most human and understandable in our gallery of villains, comes to his maleficence distraught in counsel. The awful and in fact insufficiently motivated revenge of Ferdinand is followed by a remorse more vital to the beauties of the play than the revenge itself. The Duchess is one of the first figures in the world's tragic literature, no unrelieved sombre figure, but woman, mother, wife and queen. With Cariola one says of her:

> Whether the spirit of greatness or women
> Reign most in her I know not.

The play as a whole contains many quotable passages of poetry and much impassioned philosophy. Editions: Dyce, A. (4 vols., 1830); Hazlitt, W. (4 vols., 1857); Sampson, M. W. (Belles-Lettres Series, 1904); Symonds, J. A., (Mermaid Series, 1888); Thorndike, A. H., 'Masterpieces of English Drama' (1912). Consult Gosse, E., 'Seventeenth Century Studies'; Stoll, E. E., 'John Webster, the Periods of His Work'; Ward, A. W., 'A History of English Dramatic Literature' (3 vols., 1899).

THOMAS H. DICKINSON.

DUCK. Ducks are swimming birds, with short legs set far back and fully webbed feet. They are arranged in two groups or sub-families of the family *Anatidæ*, which embraces also the mergansers, or shell-ducks, the geese and the swans. These constitute together the family *Anatidæ*, coextensive with the order *Anseres*, whose distinctive feature is that the margins of the bill bear a series of transverse ridges, varying to a semblance to teeth in the mergansers, between which mud and water may be squeezed out by the closing of the bill, while the edible parts of the mouthful are retained. This crushing-and-straining bill is usually broad and flat, often somewhat spoon-shaped, and contains a large, fleshy tongue with a horny tip. It is designed for crushing aquatic plants and other soft materials, for squeezing the nutrient out of mouthfuls of ooze and for picking up small, slippery animals.

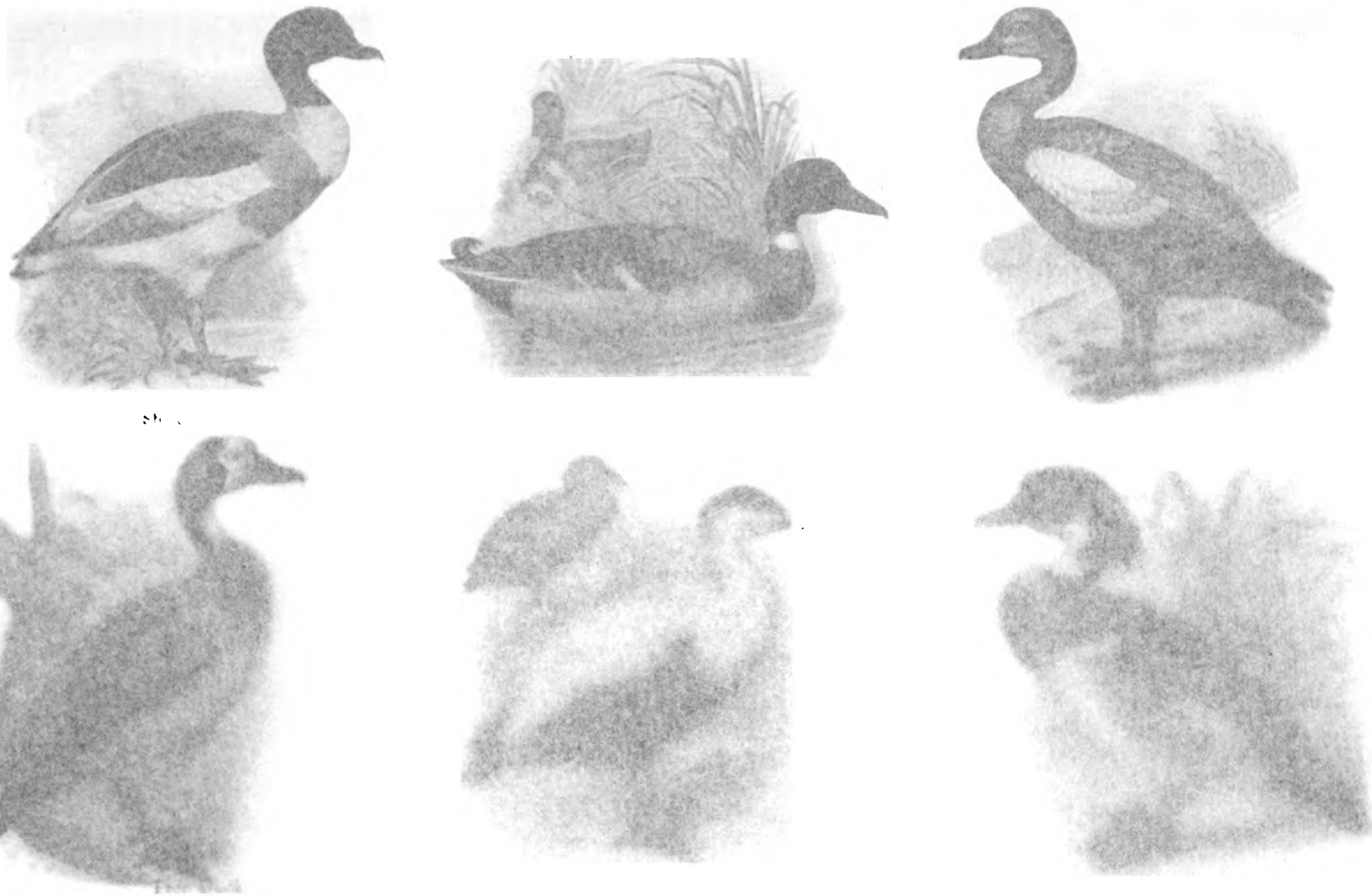
Ducks spend most of their time on or about water, where they are powerful swimmers and so expert as divers that their name (i.e., the bird that *ducks*) refers to this characteristic. Certain species descend to considerable depths in search of food, but are not able to stay long nor move far under water. Many species habitually sleep on the water, one foot dropped down and gently moving so as to keep the bird slowly turning about in nearly the same place. Adapted to this life, the plumage is exceedingly close, and is underlaid by a coat of down that protects the body from becoming wet or losing heat. In most species this plumage is different in the sexes, the male (or "drake") having as a rule richly colored dress — often of gaudy beauty — while the female (or "duck") is more soberly and protectively appareled. A distinctive feature of the dress is the *speculum*, a patch of conspicuous color in the middle of the wing which is often brilliant in color but sometimes is pure white. Molting occurs twice annually, once in summer, when most ducks pluck the loosened down from their bodies and lay it on their nests as a covering for the eggs. This is so copious in the large eiders that it has become an article of commerce. The summer or "autumnal" molt is usually succeeded by a coat for winter wear which, in the drake at least, is far less gayly colored than his spring dress, acquired in his southern winter residence; and it renders him safer from his enemies. The quills of the wings and tail are molted in pairs (one from each side) at intervals, so that the power of flight is not lost.

All ducks are very strong and swift on the wing, and many of them make semi-annual migrations between the tropics and the shore of the Arctic Ocean, and their flight is known to attain a speed of 100 miles an hour for short distances in the case of certain species; yet a duck's wing is short and rounded.

Ducks naturally belong to all parts of the world except the Antarctic continent, and many kinds are very widely distributed. About 125 species are catalogued, of which 35 are to be found in North America, not counting the merganser, geese or swans. These fall into two groups distinguished less by structure than by habits and food. The first of these groups is that of the pond and river ducks (*Anatinæ*), wherein no webbing connects the hind toe with the foot. The second group, in which the hind toe has a lobe or web, is that of the sea-ducks and bay-ducks (*Fuligulinæ*).

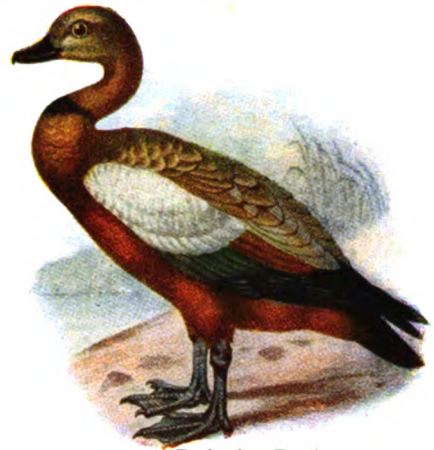
The fresh-water or anatine ducks are better known than the others, for they visit or breed along rivers, lakes and ponds all over the country. They are not as expert divers as the sea-ducks, but prefer shallow and marshy waters, where they may pick up food from the bottom without serious diving, or gather it from the grassy margins. This food is chiefly vegetable, consisting of seeds, grasses and roots, but they devour snails, aquatic insect-larvæ and any small, soft animal food met with. "The flavor of any duck's flesh," remarks Grinnell, "depends entirely on its food, and a bird of whatever kind which is killed after living for a month or two in a region where proper vegetable food is to be found will prove delicious eating." Reverse conditions will spoil the taste of species highly reputed. "Thus the fine feathers of a canvas-back are not necessarily a guarantee that the bird wearing them possesses the table-qualities that have made the species famous."

The river and pond ducks, of which about a dozen species are native to North America, are most familiar; and one of them, the mallard (*Anas boschas*) is the "wild" duck of popular speech, for it is well known throughout the whole northern hemisphere. Its head and throat are glossy green, varying to bluish black;



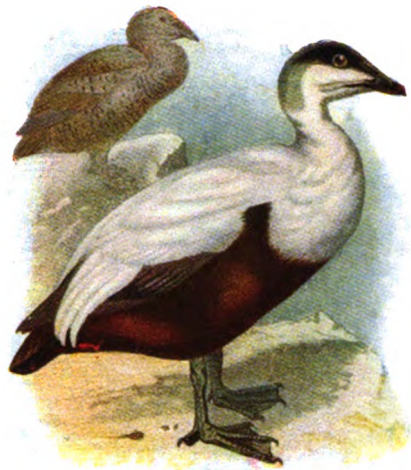
Sheldrake

Wild Duck or Mallard



Brahminy Duck

Tree Duck



Eider Duck

Wood Duck

a white ring surrounds the neck; the breast is chestnut; the belly grayish; back and tail brown to black; speculum rich purple edged by lines of white and black. The female has a much duller dress. The mallard is migratory, breeding from the northern United States to Alaska and Greenland, and wintering from the central United States southward. At these seasons it is found beside all the interior waters and formerly was extremely numerous; but the civilization of the country, the draining of the marshes and wasteful shooting previous to the enactment of recent protective laws, have caused an alarming decrease of this handsome and valuable fowl. Its nesting is after the manner of its race, which is described as follows by Dr. F. M. Chapman:

"All our *Anatinæ* except the wood-duck, nest on the ground, lining a slight hollow with grasses, leaves, moss or rootlets, and with more or less down from the breast of the incubating bird. . . . The nesting-site is usually near water. . . . The generally greenish, cream or buff eggs number from 6 to 14 and hatch within a surprisingly short time of each other. Incubation is performed by the female alone. . . . Few birds show more concern for the safety of their offspring than do the wild ducks. When danger threatens, the young, evidently acting under direction, scatter and seek cover in every direction, while the female gives a remarkable and courageous exhibition of partial helplessness."

The mallard is the original stock from which most of the domestic races of ducks have been derived; and wild pairs of these ducks are still used to breed their race in captivity in many parts of the United States and elsewhere. A considerable part of the market supply in eastern American cities comes from this source.

Another widely distributed and familiar species is the black duck or black mallard (*Anas rubripes*), which is slightly smaller than the mallard, is sooty brown with buffy markings, and has a purple speculum edged at the end with white. It neither goes so far north to breed nor so far south in winter, so that it is present and numerous at most seasons in the United States east of the plains. The gadwall (*Chaulelasmus streperus*) is an important species of the interior States, blackish in plumage, marked with buff and white, giving a brownish, scaled appearance: grayish below; wing chestnut, with a conspicuous white patch. The European widgeon frequently visits the American Atlantic coast. The American widgeon (*Mareca americana*) is better known as "baldpate," and is a handsome duck, ranging in its migrations all over the continent. Its general aspect is mottled brown and black, with the wings strikingly black and white. The crown is white, below which the sides of the head and nape are glossy green — this ornament is lacking in the female. Their loud whistling cry is known to all gunners.

The teals are small, reddish, widely distributed and favorite ducks of two Eastern species, the green-winged (*Nettion carolinense*) and the blue-winged (*Querquedula discors*), noted for their swiftness of flight, expertness in dodging and mellow whistling notes. A third species, the cinnamon teal (*Q. cyanoptera*), is restricted to the Pacific slope, and takes its name from the color of its underparts. The shoveller (*Spatula clypeata*) is so called from its great ladle-like bill, likened to a double spatula. Its head, in the drake, is green; the breast and upper parts are white, divided by a wedge of brown on the back; the under-surface is chestnut, and the wings and tail are black and green, while the feet are coral red. The female is nearly plain reddish brown. This fine duck is most common in the Mississippi Valley and obtains its food from the bottom of shallow water. The pintail (*Dafila acuta*) is another duck known throughout the northern hemisphere, and easily recognized by the two greatly prolonged central tail-feathers of the male. In general color it is dusky brown, with a reddish head, white throat and breast, green tail and green speculum. Its long neck and tail make it conspicuous among other ducks in flight.

The fresh-water group ends with the most beautiful of all American water-fowl, the wood-duck (*Aix sponsa*). It is of moderate size and the upper parts are green with purplish reflections, the breast is dull red, the sides buff and the lower breast white. The head has an elongated, drooping crest, which is divided lengthwise by a white line and is edged with white; and curving white lines ornament the neck, shoulders and coverts of the wing, which displays a speculum of steel blue. The female is equally ornamental in more quiet tones. This exquisite little duck was formerly extremely abundant, and is yet somewhat common throughout the whole temperate zone of the continent and returns only into the southern States for the winter. His haunts are waters in the midst of woods, and he has the singular habit of making his nest in some hollow in a decayed tree, often at a great height from the ground and at a long distance from water. When the young are able to scramble up to the entrance of the cavity, they are encouraged to let themselves drop off to the ground, and fall so lightly as to suffer no injury; but sometimes they are carried down by the mother, who then leads them carefully to the nearest water.

The sea and bay ducks (*Fuligulinæ*) are mostly to be found in or near salt water, but mingle with the anatine species in river-mouths and brackish marshes. Fond of open waters, many in their migrations frequent the large interior bays and lakes and are among the best for the table. "Their food," says Chapman, "consists chiefly of mollusks, crustaceans, and the seeds and roots of aquatic plants. They obtain it principally by diving, sometimes descending 150 feet or more. . . . With one exception they are northern-breeding birds, seldom nesting south of our northern tier of States."

Prominent in this group is the canvasback (*Marila vallisneria*), famous among epicures. It is rather large, has a reddish-brown head and neck, the breast and upper back black, the belly white, and the hinder half of the body covered with fine, wavy crosslines of black and white, whence its name. It is seen in autumn on every large lake east of the plains as well as along the eastern coast; and although far less abundant now than in old times is still fairly numerous owing to legal protection. Its favorite food is the aquatic weed vallisneria, erroneously called "wild celery." Very closely related, and equally

good, when equally well fed, is the redhead (*M. americana*), which has a much broader area of velvety black about the neck, and a brownish instead of a gray back; its range extends to the Pacific coast. The scaups, greater (*M. marila*) and lesser (*M. affinis*), are dark-colored, white-bellied birds, very common along the coasts in bays and salt-marshes, deriving their name from their cry. The ring-neck (*M. collaris*) differs chiefly in having a distinct chestnut collar. The golden-eye (*Clangula americana*) migrates and breeds throughout the northern interior, and is singular in nesting in a hole in a tree, like the wood-duck. It has a glossy green head, with a puffed appearance, due to the length of the feathers, and marked by a large round white spot before the eye. Otherwise it is white with a black back, the female being all brown. The whistling noise of its wings in flight make it known to gunners as "the whistler." The bufflehead, harlequin and old squaw are sea ducks with a highly varied and beautiful plumage, while the scoters are dull in plumage and the eiders (see EIDER DUCK) are big, black-and-white ducks of the north, of little interest to sportsmen, and not utilized in this country as is the case in Iceland and northern Europe. The pretty little ruddy ducks close the list.

Domestic Ducks.— The various races of domesticated ducks are derived from local wild stock. In Europe and North America the mallard has been the chief progenitor, but in the East and in Africa other species have contributed. The variation resulting from selective breeding and from the mingling of breeds has resulted in about a dozen well-marked varieties, 10 of which at least are recognized at shows. Of these the white Aylesbury and white Pekin, a Chinese duck (introduced to the United States about 1870), are the most popular as table ducks; but the handsomely colored Ruen, a favorite in France, the black Cayuga and the white and colored muscovies are considered profitable to raise. The muscovy duck is not of Russian origin, as its name would imply, but is a native of South America, and is noted for its ornamental plumage, which much resembles that of our wood-duck. It is therefore reared and kept mainly as an ornamental bird. The crested white is another purely ornamental bird, while several strains of pretty bantams are bred by fanciers in emulation at shows.

The breeding of wild ducks in captivity is becoming a serious business, as well as an amusement of country gentlemen. The National Association of Audubon Societies has led the way by means of its experiment station in Connecticut, and has shown it to be possible to rear a large variety of ducks not before attempted, including canvasbacks, black ducks, teals, goldeneyes, etc.

Bibliography.— In addition to general works (see under BIRDS) may be mentioned Baird, Brewer and Ridgway, 'Water Birds' (2 vols., 1905); Dionne, 'Oiseaux de la Province de Quebec' (1889); Elliot, 'Wild Fowl of North America' (1898); Forbush, 'Game Birds, Water Fowl and Shore Birds' (1912); Grinnell, 'American Duck Shooting' (1901); Job, 'Among the Water Fowl' (1902); Leffingwell, 'Shooting in Upland, Marsh and Stream' (1890); Rich, 'Feathered Game of the Northeast' (1907).

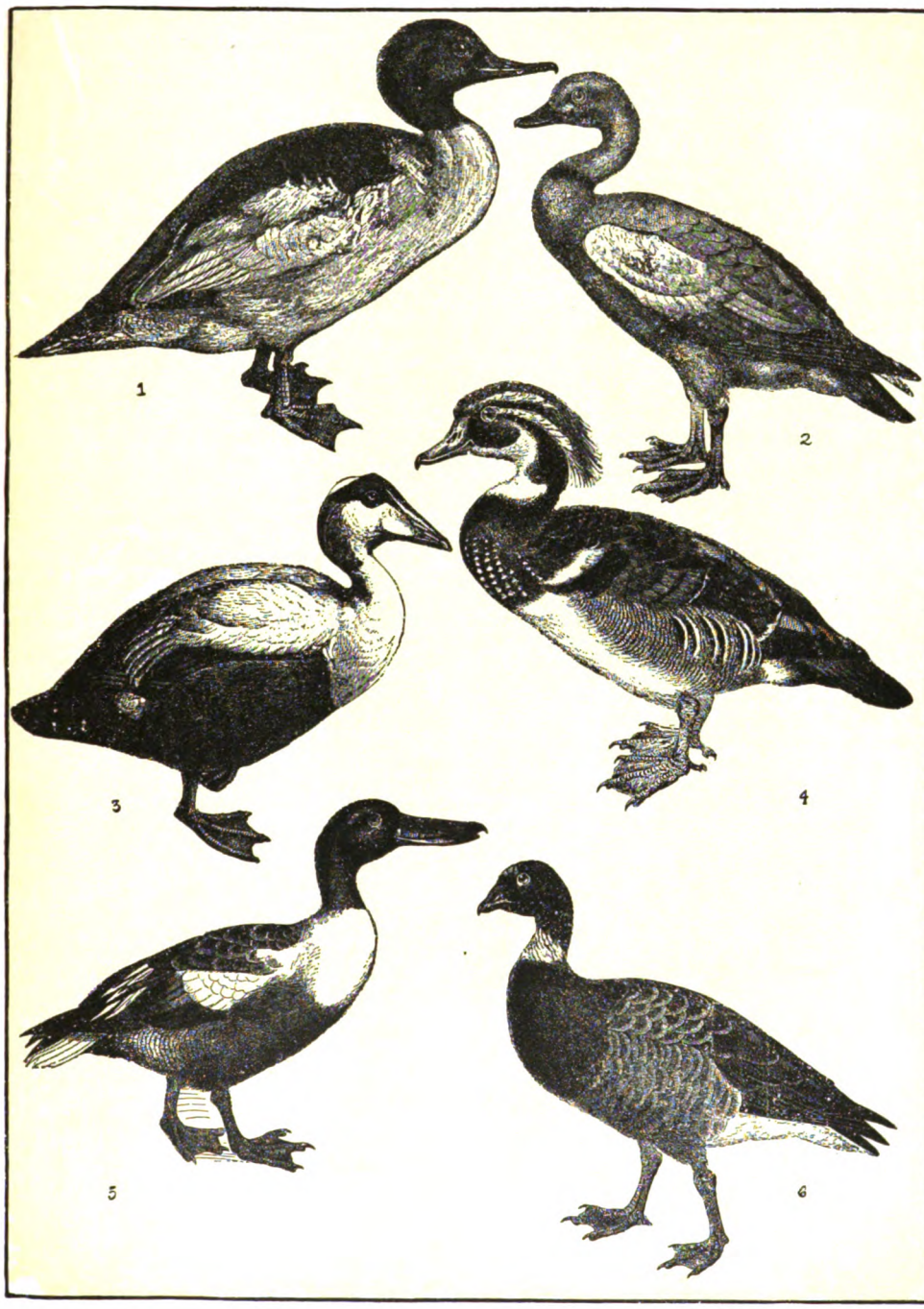
ERNEST INGERSOLL.

DUCK ANT. See TERMITES.

DUCKBILL, or PLATYPUS, an aquatic egg-laying mammal. (*Ornithorhynchus paradoxus*), native of the sluggish rivers of Australia, Papua and Tasmania. Its entire length from tip of bill to tip of tail is usually between 18 and 20 inches. Its body is rather long and covered with glossy blackish hair, close to the roots of which is a soft waterproof undercoat of fur similar to that of the beaver. The head is rounded, the eyes are small and bright and there are no external ears, despite which fact the creature's hearing is very acute. The feature which gives its name to the animal is the duck-like bill, which is the substitute for the muzzle of other animals. This bill is formed of the elongated jawbones covered with a highly sensitive, smooth skin; when the teeth are shed, as they are at maturity, horny plates developed on both jaws take their place and do their work. The duckbill is well adapted to its aquatic and burrowing habits. Its legs are short, its feet webbed and furnished with sharp claws. In the fore-feet the web extends far beyond the claws, but can be folded back out of their way. The tail is broad and flattened, covered with coarse hair and nearly naked on the other side. In habits the duckbill is almost entirely aquatic, spending its life in or near rivers, but carefully avoiding stagnant or brackish waters. In swimming it propels itself mainly by the aid of its fore-feet, and it dives well. It is gregarious and sometimes congregates in considerable numbers, but is so shy that unless one watches quietly at evening he will not see a single member of the company. The least hint of danger sends them all to the bottom. The food is often collected in the large cheek pouches, where it can be stored and conveniently carried home by the animal. Each pair lives in a burrow in the bank — a gallery or passageway widened out at its interior extremity into a chamber, where the occupants sleep by day and whither the female retires to produce her young. She lays few eggs in her bed of dry grass, often only one, and hatches her young in a comparatively short time. When born they are naked and blind. The eggs are white, about three-fourths of an inch long by one-half inch wide and, unlike birds' eggs, have a soft and somewhat flexible shell — though, in their having a large amount of food-yolk, they resemble birds' eggs. The food consists of aquatic insects, crustaceans and worms, which live in the water or in the mud and which are found not only by the tactile sense in the bill but also by the unusually keen sense of smell. The voice is like the growl of an angry puppy, but the disposition is quiet and gentle.

DUCKING STOOL, also known as "cucking stool" and "castigatory," a chair in which common scolds were formerly securely fastened to receive their punishment of being ducked in water. The culprit was placed in the chair with arms drawn backward; a bar was placed across the back and inside the elbows, while another bar held the body upright; in this uncomfortable position the prisoner was securely tied with cords. The persons appointed to carry out the punishment by raising their end of the beam caused the unfortunate culprit to go overhead into the water. By pulling down their end with a chain the victim was once more brought to the surface. The ducking stool was generally

REPRESENTATIVE DUCKS AND GEESE



1 Goosander (Mergus merganser)
2 Brahminy Duck (Tadorna casarca)
3 Elder (Somateria mollissima)
4 Wood Duck (Aix sponsa)
5 Shoveler (Anas Clypeata)
6 Bernicle Goose (Branta bernicla)

used in Great Britain from the 15th to the 18th century, and one case was known as late as 1809.

DUCKWEED, a genus of plants by some botanists made the type of the small order *Lemnaceæ.* The species are small plants which float on the surface of stagnant ponds or slow running streams and are eaten by ducks and geese. The fronds take the place both of the stems and leaves, and are usually of a bright green color. The flowers arise from a slit just below the margin of the frond. Vegetable reproduction may take place by budding. The family comprises the very smallest of the flowering plants and contains three genera, all of which are to be found in North America. Of the 26 species in the family the most numerous in the United States are those of the genus *Lemna,* of which five are found. The other genera are *Spirodela* and *Wolffia.*

DUCKWITZ, dük'vits, **Arnold,** German politician: b. Bremen 1802; d. 1881. He made an extensive tour of England and the Netherlands and on his return became the foremost promoter of shipbuilding in Germany. He advocated a large merchant marine and a powerful navy. He also advocated the establishment of a German customs union and proposed extensive harbor improvements at Bremen. Through his efforts a steamship line was established between Bremen and New York and a favorable postal treaty concluded with the United States. In 1848 Duckwitz as Imperial Minister of Commerce and Naval Affairs laid ambitious plans for the construction of a great German navy. Returning to Bremen in 1849 he was elected burgomaster in 1857 and was re-elected in 1866. He retired from public life in 1873. He published memoirs under the title 'Denkwürdigkeiten aus meinem öffentlichen Leben 1841-66' (Bremen 1877).

DUCKWORTH, Sir John Thomas, English admiral: b. Leatherhead, Surrey, 28 Feb. 1748; d. Devonport, England, 31 Aug. 1817. Between 1776 and 1779 he served in America. He distinguished himself in 1794 in the great naval victory gained by Lord Howe off Ushant, and in 1798 under Earl St. Vincent acquired new fame at the capture of Minorca. Some years later he set out in pursuit of a French fleet which had sailed to the West Indies to succor Santo Domingo. He came up with it and succeeded in capturing an 80- and three 74-gun ships. For this service he received the thanks of both houses of Parliament and was presented by the city of London with its freedom and a sword of the value of 200 guineas, and by the assembly of Jamaica with thanks and a sword of the value of 1,000 guineas. In 1807, having been appointed to watch the Turkish fleet, he forced the passage of the Dardanelles. Between 1810 and 1815 he was governor of Newfoundland.

DUCLERC, dü-klärk, **Charles Théodore Eugène,** French statesman: b. Bagnères-de-Bigorre, France, 9 Nov. 1812; d. Paris, 21 July 1888. He took an active part in the Revolution of 1848, was a speaker in the Constituent Assembly and Minister of Finance for a time. He was elected vice-president of the National Assembly in 1875, chosen a senator for life in the same year and became Premier in 1882.

DUCLOS, dü-klō', **Charles Pinot,** French historian and novelist: b. Dinant, Brittany, 12 Feb. 1704; d. Paris, 26 March 1772. He was chosen member of the Academy of Inscriptions in 1739 and in 1747 member of the French Academy, of which he was afterward appointed permanent secretary. In 1750 he was appointed to succeed Voltaire as historiographer of France. Among the best of his novels are 'Confessions du comte de Bellipse' (1741). His 'Considérations sur les mœurs de ce siècle' are full of striking sketches of character and deep knowledge of human nature. His 'History of Louis XI' is esteemed, but shows the hand of the novelist. Of more value are his 'Mémoires secrets sur les règnes de Louis XIV et XV.' This work was composed in his character of historiographer. He also distinguished himself in his 'Remarques sur la grammaire générale de Port Royal' as a grammarian.

DUCORNET, dü-kôr'nā', **Louis César Joseph,** French artist: b. Lille, 10 Jan. 1806; d. Paris, 27 April 1856. Born without arms he learned in early childhood to use his feet for hands and when 13 years old showed such skill in drawing with his toes that Watteau received him as a pupil in the Lille Academy of Design. There his ambition to become a painter received wholesome encouragement. At the end of three years he took the first prize for a drawing of the human figure from life and received a pension from the city, which the government subsequently increased. He then went to Paris for more advanced study, painted 'The Parting of Hector and Andromache' (1828) and presented it to his native city. He continued painting till within a few weeks of his death. His last work of note, 'Edith Finding the Body of Harold,' was ordered by Napoleon III and exhibited in 1855.

DUCTILIMETER, an instrument invented by M. Regnier for ascertaining the relative ductility of metals. The metal to be tested is subjected to the action of blows from a mass of iron of given weight attached to a lever, and the effect produced is shown upon a graduated arc.

DUCTILITY, the quality of adaptedness of solid bodies, particularly metals, which render them capable of being extended by drawing into wire; as malleability is for being beaten into leaves. The order of metals in these two respects is as follows: Ductility — platinum, silver, iron, copper, gold, zinc, tin, lead and nickel; malleability — gold, silver, copper, tin, platinum, lead, zinc, iron and nickel. By the device of coating a platinum wire one-one hundredth of an inch in diameter with silver, and then drawing the two metals together as fine as possible, and then dissolving away the silver coating with nitric acid, a platinum wire three-one-hundred-thousandths of an inch in diameter has been obtained — so fine that one mile of it would weigh only one-twenty-fifth of a grain. This wire has entirely superseded the spider's thread formerly used as the «cross hairs» in telescopes. The less ductile soft metals, such as magnesium, which cannot be drawn, are converted into the form of wire by the process of pressing or squirting the heated metal from a nozzle. One effect of drawing metals into wire is to increase to a great degree their ultimate tensile strength. Thus a wire of Swedish iron one-thirty-sixth of an inch in diameter has a breaking strain of 90,000 pounds per square inch; while a wire of

one-two-hundred-and-fiftieth of an inch will not break until the strain is 134,000 per square inch. When glass is subjected to a sufficient degree of heat it can be managed like soft wax and may be drawn out into threads exceedingly long and fine. Ordinary spinners do not form their threads of silk, flax or the like, with half the ease and expedition the glass-spinners do threads of this ordinarily brittle matter. Some of them are made into plumes of filaments much finer than hair, which bend and wave, like hair, with every wind. Two workmen are employed in making them. The first holds one end of a piece of glass over a flame and when the heat has softened it the second operator applies a glass hook and draws out a thread of glass, which still adheres to the mass; then fitting his hook on the circumference of a wheel about two and one-half feet in diameter, he turns the wheel as fast as he pleases till it is covered with a skein of glass thread. The parts, as they recede from the flame, by gradually cooling become more cohesive, the parts nearest the fire are least cohesive and consequently must give way to the effort made to draw them toward the wheel. These threads are commonly of a flat, oval shape, being three or four times as broad as thick; some of them seem scarcely bigger than the thread of a silk-worm, and are surprisingly flexible. If the two ends of such threads are knotted together they may be drawn and bent till the aperture or space in the middle of the knot does not exceed one-fourth of a line or one-forty-eighth of an inch in diameter. The flexibility of glass increases in proportion to the fineness of the threads; and, probably, had we the art of drawing threads as fine as those of a spider's web, we might weave stuffs and cloths of them. Familiar instances of ductility in non-metallic substances are the "hairing" of boiling sugar syrup in candy-making; and the similar drawing out of "threads" of glue from the carpenter's glue-pot.

DUDE, a modern word coined as a slang expression (but now, by constant use, dignified into semi-respectability) to designate a brainless fop, whose whole business and aim in life are like those of Carlyle's dandy — to wear clothes. The term is said to have originated in London about 1882, at the time of the so-called "æsthetic" movement in dress and manners among the ultra-society folk.

DU DEFFAND, Madame. See DEFFAND.

DUDEVANT, düd-vän, **Madame.** See SAND, GEORGE.

DUDLEY, SIR **Edmund,** English politician: b. about 1462; d. London, 18 Aug. 1510. He was educated at Oxford and Gray's Inn, and in 1497 was appointed under-sheriff of London. He was an instrument of Henry VII in the arbitrary acts of extortion by the revival of obsolete statutes and other unjust measures practised during the latter years of his reign. In 1504 he was speaker of the House of Commons. On the accession of Henry VIII he was arrested for high treason and perished on the scaffold with his associate, Sir Richard Empson. His work in defense of absolute monarchy, entitled 'The Tree of Commonwealth,' was published in 1859.

DUDLEY, LORD **Guildford,** English noble: d. London, 12 Feb. 1554. He was a son of John, Duke of Northumberland, and was married in 1553 to Lady Jane Grey (q.v.), whose claim to the throne the duke intended to assert on the death of Edward VI. On the failure of the plot Lord Guildford was condemned to death, but the sentence was not carried into effect till the insurrection of Wyatt induced Mary to order his immediate execution.

DUDLEY, John, DUKE OF NORTHUMBERLAND and EARL OF WARWICK: b. 1502; d. London, 22 Aug. 1553. He was a son of Sir Edmund Dudley (q.v.). He was with Bedford's expedition in Scotland (1542); led the assault on Boulogne (1544); created Earl of Warwick (1546); distinguished himself at the battle of Pinkie in 1547 and suppressed Ket's rising in Norfolk in the same year; was created earl, marshal and Duke of Northumberland in 1551, and was instrumental in bringing Somerset to the scaffold. He manifested the most insatiable ambition. The illness of Edward VI, over whom he had gained complete ascendency, aroused his fears, and he endeavored to strengthen his interest by marrying his son, Lord Guildford Dudley, to Lady Jane Grey, descended from the younger sister of Henry VIII, and persuaded Edward to settle the crown on his kinswoman by will, to the exclusion of the Princesses Mary and Elizabeth. The death of the king, the abortive attempts to place Lady Jane Grey on the throne and the ruin of all those concerned in the scheme are among the most familiar events in the annals of England. "A consummate soldier, a keen politician and a skilful administrator," he had nevertheless the vices of avarice and unbounded personal ambition, and despoiled the religious houses for his own enrichment.

DUDLEY, Joseph, American colonial governor of the province: b. 23 Sept. 1647; d. Roxbury, 2 April 1720. He was a son of Thomas Dudley (q.v.). He was graduated at Harvard College in 1665, served in the Indian War in 1675, was sent to England as agent for the province in 1682, appointed president of New England in 1686, superseded by Andros a few months later and made chief justice. He suffered imprisonment for malpractices 1689-90; was sent to England for trial, but the proceedings were quashed; was chief justice of New York from 1690 to 1693, then eight years lieutenant-governor of the Isle of Wight; was returned to Parliament in 1701 and finally governor of Massachusetts from 1702 to 1715. His character has been pithily summed up by the historian: "Dudley united rich intellectual attributes with a grovelling soul. To his mean nature personal aggrandizement was the prime necessity." "He had as many virtues as can be consistent with so great a thirst for honor and power."

DUDLEY, Paul, American colonial chief justice: b. 3 Sept. 1675; d. Roxbury, Mass., 21 Jan. 1751. He was a son of Joseph Dudley (q.v.). He was graduated at Harvard College in 1690, and afterward studied law in London. He returned to Massachusetts in 1702, with the commission of attorney-general; in 1718 was appointed judge and in 1745 became chief justice. By his will he bequeathed £100

to Harvard College, the interest of which was to be applied to the support of an annual lecture course, named in his honor. He was well learned in natural history and was a Fellow of the Royal Society of London.

DUDLEY, Plimmon Henry, American metallurgical engineer: b. Freedom, Ohio, 21 May 1843. He was chief engineer of Akron, Ohio, 1868–72, and subsequently invented the dynagraph (1874), the track indicator (1880), and the stremmatograph for obtaining and registering stresses in rails. In 1883 he designed the first five-inch steel rail used in the United States, and in 1892 introduced the first six-inch 100-pound rails. In 1902 he stated seven fundamental principles which illustrate the American theory and practice of railroads, in reference to the conjoint action of the locomotives, rolling-stock and permanent way. In 1916 he discovered a test method by which the flaws in steel rails may be found. He is a member of the American Institute of Mining Engineers and of many other societies.

DUDLEY, Robert, EARL OF LEICESTER, English courtier: b. 24 June 1532 or 1533; d. Cornbury, Oxfordshire, 4 Sept. 1588. He was the fifth son of John Dudley, Duke of Northumberland, and though involved in the criminal designs of his father and included in the sentence of attainder passed against him on the accession of Mary, was pardoned and employed by that queen. After Elizabeth ascended the throne Dudley soon acquired the distinction of being her favorite. Offices, honors and wealth were showered on him. He was appointed master of the horse, knight of the Garter and privy councillor; and received grants of the princely domains of Kenilworth, Denbigh and Chirk Castle. In 1564 he was created Baron Denbigh and Earl of Leicester, and was the same year elected chancellor of Oxford University, having previously been chosen to the same office at Cambridge. He commanded the expedition to the Low Countries in 1585–87 in which he showed no military capacity; and in 1588 was appointed captain-general of the queen's forces to resist the Armada. Cordially detested by the old nobility, he was simply a creature of the queen, who was for long credited with an intention to marry him; but who proposed a marriage (1563) between him and Mary of Scotland. In spite of Queen Elizabeth's favor, he sent presents to the imprisoned Queen Mary and was privy to the Norfolk plot, anticipating at that time the fall of Elizabeth. The tragic death of his first wife, Amy Robsart, who was found dead at the foot of the stairway at Cumnor Place, has been laid to his charge, without, however, conclusive evidence. Consult Scott's 'Kenilworth.'

DUDLEY, Thomas, American colonial governor: b. Northampton, England, 1576; d. Roxbury, Mass., 31 July 1652. After serving as page to Lord William Compton; captain in the English army which fought the French in 1597, he became a clerk to Judge Nicolls, about 1598, and steward to the Earl of Lincoln 1616–28. He came to Massachusetts in 1630 with the commission of deputy governor and he was afterward chosen governor in the years 1634, 1640, 1645 and 1650. He participated in the founding of Newton (now Cambridge, Mass.) and of Harvard College. He was twice elected president of the United Colonies of New England. He was a man of integrity and piety, though intolerant, like most of his generation. Consult Jones, 'Life and Work of Thomas Dudley' (1899).

DUDLEY, Thomas Underwood, American Protestant Episcopal bishop: b. Richmond, Va., 26 Sept. 1837; d. New York, 22 Jan. 1904. He was graduated from the University of Virginia in 1858 and served in the Confederate army during the Civil War, attaining the rank of major. Completing his studies at the Virginia Theological Seminary he was ordained in 1868 and after filling the rectorship of Christ Church, Baltimore, was made assistant bishop of Kentucky in 1875, and became bishop of the diocese 1884. He has published 'A Wise Discrimination of the Church's Need.'

DUDLEY, William Lofland, American scientist: b. Covington, Ky., 16 April 1859; d. Nashville, Tenn., 8 Sept. 1914. He was graduated at the University of Cincinnati in 1880, and from 1880 to 1886 was professor of chemistry and toxicology at Miami College. His iridium process for electroplating is very successful. He discovered the most poisonous principle in tobacco smoke to be carbon monoxide, which, when inhaled, deoxidizes the blood. He first discovered physiological effects from the use of the X-ray. He was professor of chemistry at Vanderbilt University, being also dean of the medical department, from 1886 until his death.

DUDLEY, England, city, parliamentary and county borough in Worcestershire, eight miles northwest of Birmingham. It is situated in the midst of the "black country" at an altitude of 600 feet, with extensive coal fields surrounding it. The principal manufactures are articles made from brass and iron; flint-glass, tanning and brewing, cycles and telegraph insulators. There are here the remains of a castle, said to have been founded in the 8th century by a Saxon prince called Dudo or Dud, who has given the town its name. Pop. of county borough 51,079; of parliamentary borough, 102,506.

DUDLEY DIAMOND, The, a diamond found in South Africa in 1868, weighing originally 89 carats, but reduced to half that weight in cutting. It receives its name from its owner, the Earl of Dudley, who bought it for $150,000. See DIAMOND.

DUDWEILER, dood'vī-lėr, Germany, town in Rhenish Prussia, about 45 miles northeast of Metz. The coal fields near by are a source of wealth to the town; and the chief manufactories are iron works, fireproof bricks and potteries. In the vicinity is Brennender Berg (Burning Mountain), a mountain composed largely of coal which has been burning for over 200 years. Pop. 21,932.

DUE BILL, a written acknowledgment of a debt by the debtor. Its familiar form is the I. O. U. with the signature of the debtor, as follows: "I. O. U. twenty-five dollars. Benjamin Levine." Another and more extended form is the following: "Due McDonnell and Heyburn twenty-five dollars; value received. Benjamin Levine." Such an acknowledgment of indebtedness is distinguished from a promissory note

by the absence of an express promise to pay. A due bill is not a negotiable instrument, although it is assignable by the payee.

DUE PROCESS OF LAW, law in its regular course of administration through courts of justice. This term, due process of law, which occurs in the amendments to the Constitution of the United States (Art. V) and in the constitutions of nearly all of the States, is considered by Coke as equivalent to the phrase "law of the land" (used in Magna Charta, Ch. 29), and is said by him to denote "indictment or presentment of good and lawful men." Coke Inst. 50. Due process of law includes notice, hearing and judgment. The constitutions of the various States and the Federal Constitution contain no description of those processes which it was intended to allow or forbid. As a general rule they do not even declare what principles are to be applied to ascertain whether it be due process. It is manifest that it was not left to the legislative power to enact any process which might be devised. As used in the Constitution of the United States, the article is a restraint on the legislative as well as on the executive and judicial powers of the government and cannot be so construed as to leave Congress free to make any process "due process of law" by its mere will. It has been held that the amendment to the Constitution of the United States does nothing more than declare a great common-law principle applicable to all governments, both State and Federal, which has existed from the time of Magna Charta. It was held by the Supreme Court of the United States in Murray *v.* Hoboken Co., 18 How. 272, that the words "due process of law" were undoubtedly intended to convey the same meaning as the words "law of the land" in Magna Charta. Due process of law ordinarily implies and includes a complainant, a defendant and a judge, regular allegations, an opportunity to answer and a trial according to some settled course of judicial proceeding. When applied to proceedings in criminal cases, the expression "due process of law," or the "law of the land," means that no person shall be deprived of life, liberty, property or privileges without indictment or presentment by "good and lawful men," selected, organized and qualified in accordance with some pre-existing law, and a trial by a court of justice, according to the regular and established course of judicial proceedings. It is to be regretted, however, that the constitutional meaning or value of the phrase "due process of law" remains to-day without that satisfactory precision of definition which judicial decisions have given to nearly all the guarantees of personal rights found in the constitutions of the several States and of the United States. Consult Cooley, 'Constitutional Limitations' (6th ed., Boston 1890); Hare, 'American Constitutional Law' (Boston 1889); McGehee, 'Due Process of Law under the Federal Constitution' (Chicago 1906); McLaughlin and Hart, 'Encyclopedia of American Government' (New York 1914).

DUEL AND DUELING (from *duellum,* derived from *duo*) is a combat between two, at a time and place appointed in consequence of a challenge, and so is distinguished from an encounter taking place without any previous arrangement. The custom of dueling was derived from the Germans, Danes and Franks, who carried the practice of the judicial combat so far that none were excused except women, sick people, cripples and such as were over 60 years of age. Even ecclesiastics and monks were obliged to maintain their controversies by a champion in arms; and this singular species of jurisprudence was not confined to criminal accusations, but the titles to estates were decided in the same manner. At length, however, this mode of trial was limited to those accusations of capital offenses in which there was no other testimony and in which common fame pronounced the accused party to be guilty. The party vanquished was punished by hanging, beheading or mutilation of members. A judicial combat was authorized by Gundebald, king of the Burgundians, as early as 501 A.D. The practice of trying rights to land, as well as the guilt or innocence of an accused party, by combat under judicial authority, very naturally suggested the decision of personal quarrels in the same way, and all cases in which there was no adequate redress provided in the ordinary tribunals.

The example of Francis I of France and Charles V of Spain gave a sanction to this mode of arbitration. On the breaking up of the treaty between these sovereigns and the declaration of war by the French and English heralds at the court of Charles, 2 Jan. 1528, the emperor, in replying to the declaration of the French monarch, desired the herald to acquaint his sovereign that he would henceforth consider him not only as a base violator of public faith, but as a stranger to the honor and integrity becoming a gentleman. On receiving this message Francis immediately sent back the herald with a cartel of defiance, gave the Emperor the lie in form, challenged him to single combat and required him to appoint the time, place and weapons. Charles accepted the challenge; but after many messages concerning the arrangements for the combat, accompanied with mutual reproaches bordering on the most indecent scurrility, all thoughts of the duel were given up. But this affair, though it thus terminated without any encounter, is supposed to have had a great influence in producing an important change in manners all over Europe. Upon every insult or injury which seemed to touch his honor a gentleman thought himself entitled to draw his sword and to call on his adversary to give him satisfaction. Dueling raged with the greatest violence in France, where it is calculated that 6,000 persons fell in duels during 10 years of the reign of Henry IV. His celebrated minister, Sully, remonstrated against the practice; but the king connived at it, supposing that it tended to maintain a military spirit among his people. But afterward, in 1602, he issued a very severe decree against it and declared it to be punishable with death; and at the same time commanded any person who had suffered wrong or received an insult to submit his case to the governor of the province, in order that it might be considered by a tribunal consisting of the constables and marshals of France. This decree, however, accompanied by the institution of a tribunal of honor, did not put an end to duels in France. Richelieu was firm in carrying out all edicts by which he hoped to check the power of the nobility, and accordingly insisted

on the strict observance of those against duels. Under his ministry the Count of Bouteville-Montmorency suffered death in 1627 for having violated a decree of the French Parliament against dueling. This had for a time the effect of deterring others from engaging in this practice. During the minority of Louis XIV the law was more feebly administered and more than 4,000 nobles are said to have lost their lives in duels. With the revolution of 1789 commenced the period of legal impunity for duels and a new class of duels became common, those, namely, between men engaged in politics. Bills, with a view to put down the practice, were brought forward in the Chambers in 1829 and 1830 and a similar proposal was made to the Council of State in 1832; but they were not accepted. At last, in 1837, the Court of Cassation determined to follow a new law with regard to duels, and protesting against the practice in the name of morality and law, it decided that in case of death or injury resulting from a duel the principal parties and the seconds should be proceeded against and punished in accordance with the general provisions of the *code pénal*. The French courts, however, reserve to themselves a discretionary power in dealing with cases of dueling, and the practice is by no means yet obsolete in France.

Single combats are said to have been introduced into England by the Normans. In the time of chivalry numerous single combats took place in England, which, in the proper sense of the term, can scarcely be called duels. It may be said that the duel, strictly so called, was introduced into England about the same time that it became common in France, such was the contagion of the example of Francis I and Charles V. In the reign of James I of England there were numerous cases of dueling, the most celebrated of which is that in which Lord Bruce and Lord Sackville (afterward Lord Dorset) were the principals and in which the former was killed. Cromwell was an enemy of the duel and during the protectorate there was a cessation of the practice. It came again into vogue, however, after the Restoration, thanks chiefly to the Gallican ideas that then inundated the court of Saint James. Some of the duels of that epoch are in perfect accord with the loose morality then prevalent. An instance of this is the duel in which the Duke of Buckingham killed the Earl of Shrewsbury, while the wife of the latter, the cause of the duel, who had accompanied the duke to the ground, witnessed the encounter in the dress of a page. A striking thing is that as society became more polished in England duels became more frequent. They were never more numerous than in the reign of George III. Among the principals in the fatal duels of this period were Charles James Fox, Sheridan, Pitt, Canning, Castlereagh, the Duke of York, the Duke of Richmond and Lord Camelford. The last-mentioned was the most notorious duelist of his time and was himself killed in a duel in 1804. Of all the duels which took place during the reigns of George IV, William IV and Queen Victoria, the most celebrated is that which was fought between the Duke of Wellington and Lord Winchelsea in 1829, the cause of which was certain animadversions which Lord Winchelsea had passed on the duke's conduct in connection with the Catholic Emancipation Bill. The duel passed off without any injury being done to either of the parties engaged. The Duke of Wellington missed his aim, whereupon Lord Winchelsea fired into the air and apologized. Since 1844, when stringent regulations against the practice were passed, dueling has become extinct in the British army.

Generally on the continent of Europe the practice obtains among the great conscriptionist nations. An anti-dueling league has been formed, in which one of the leading spirits is the Infanta Alfonso, a member of the Spanish royal house, and its operations embrace France, Belgium, Germany, Austria and Spain. Dueling is still practised in Germany and is recognized as having a defined position in the army. As an illustration of the military viewpoint the following case may be cited. Dr. Sambeth, an army officer, in May 1912 was challenged by a brother officer, but as he was a Catholic he refused to accept it, the Church having pronounced against it. On the question being submitted to him, the Emperor William decided as follows: "The refusal to fight a duel based on religious conviction is not a subject for examination by a court of honor, but the medical officer who in this respect holds opinions contrary to those of his fellow officers, cannot be allowed to remain in the service." Accordingly, he was dismissed from the army. A resolution against dueling passed by the Reichstag in 1912 was negatived by the Bundesrath in 1913. There were 13 duels fought by army officers in the latter year. Dueling is still practised at the universities in Germany and to a less extent in Russia, but these are very seldom serious affairs, being rather fencing matches with sharp weapons than duels proper. The combatants are generally padded all over the body except the face and sword-arm. The late Emperor Francis Joseph of Austria exercised his influence against dueling, counseling (1913) aggrieved officers to seek redress in the law courts. General Kuropatkin is a notable opponent of dueling in Russia. Victor Immanuel III of Italy some years ago directed an officer who had provoked a duel to be dismissed from the army and sentenced the principals and seconds to terms of imprisonment.

Dueling has been known in the United States from the very beginning of their settlement, the first duel taking place in 1621, at Plymouth, between two serving men. In 1728 a young man named Woodbridge was killed in a duel on Boston Common by another young man named Phillips. They fought without seconds, in the night time, and with swords. Aided by some of his friends, Phillips got on board a man-of-war and escaped to France, where he died a year afterward. There were few duels in the Revolution, the most noted being those between Gen. C. Lee and Col. John Laurens, in which the former was wounded, and between Generals Cadwallader and Conway, in 1778, in which the latter received a shot in the head from which he recovered. Button Gwinnett, one of the signers of the Declaration of Independence, from Georgia, was killed in a duel with General McIntosh, in May 1777. In 1785 Captain Gunn challenged General Greene twice, both being citizens of Georgia, and threatened a personal assault when the latter refused to meet him. Greene wrote to Washington, acknowledging

that if he thought his honor or reputation would suffer from his refusal he would accept the challenge. He was especially concerned as to the effect of his conduct on the minds of military men and admitted his regard for the opinion of the world. Washington approved of his course in the most decisive terms, not on moral grounds, but because a commanding officer is not amenable to private calls for the discharge of his public duty.

Alexander Hamilton was killed in a duel with Aaron Burr in 1804, the latter being Vice-President and the former the greatest leader of the opposition. This duel is always allowed the first place in the history of American private combats. That which stands next is the duel between Captains Barron and Decatur, the latter being killed and Barron severely wounded. Henry Clay and John Randolph fought in 1826, and Colonel Benton, in closing his account of the fight, says: "Certainly dueling is bad, and has been put down, but not quite so bad as its substitute — revolvers, bowie knives, blackguarding, and street assassinations under the pretext of self-defense." General Jackson killed M. Dickinson in a duel, and was engaged in other "affairs." Colonel Benton killed a Mr. Lucas and had other duels. In 1841 Mr. Clay was on the verge of fighting with Colonel King, then a senator from Alabama and elected Vice-President in 1852. Mr. Cilley of Maine fought with Mr. Graves of Kentucky in 1838, near Washington, and the former was killed. This duel caused nearly as much excitement as that between Hamilton and Burr. Both parties were members of Congress. Duels have been numerous in California, notably the combat between Terry and Broderick. Formerly they were very common in the United States navy and valuable lives were lost. It is related of Richard Somers, who perished in the *Intrepid,* and who is said to have been a mild man, that he fought three duels in one day. In 1830 President Jackson caused the names of four officers to be struck from the navy roll because they had been engaged in a duel. Since the Civil War stringent laws have been passed in all the States against dueling and the practice has become obsolete in this country.

Dueling in Upper Canada (now Ontario) was illegal and the person guilty of so taking life was liable for murder, but by the "unwritten law" the Crown counsel, if the combat was fairly conducted, did not press for conviction. Perhaps the most celebrated duel fought in the early days of the colony was that between William Weekes and William Dickson, and took place behind a bastion of old Fort Niagara, on the American side of the river, on 10 Oct. 1806. Weekes was killed; but as the duel had been fought in a foreign country, Dickson was never brought to trial. What is regarded as the last duel in Upper Canada took place on the banks of the river Tay at Perth on 13 June 1833 between John Wilson (afterward puisne judge of the Common Pleas of Ontario) and one Robert Lyon, in which the latter was mortally wounded; but following the customary practice, the fight having been a fair one, the jury did not convict.

Bibliography.— Douglas, 'Duelling Days in the Army' (1887); Massi, 'History of Duelling in All Countries' (1880); Milligen, 'History of Duelling' (1841); Sabine, 'Notes on Duels and Dueling' (1855); Steinmetz, 'The Romance of Duelling' (1868); Truman, 'The Field of Honor' (1884).

DUER, dū'ėr, **John,** American jurist: b. Albany, N. Y., 7 Oct. 1782; d. Staten Island, 8 Aug. 1858. He commenced the practice of law in Orange County, N. Y., whence about 1820 he removed to the city of New York, where he resided until his death. In 1825 he was appointed one of the commissioners to revise the statute law of the State and in 1849 was elected a justice of the Superior Court of New York, a position which he filled until his death. He published 'Lecture on the Law of Representations in Marine Insurance' (1845); 'Law and Practice of Marine Insurance' (2 vols., 1845–46), which has become a standard authority in the United States.

DUER, William Alexander, American jurist: b. Rhinebeck, Dutchess County, N. Y., 8 Sept. 1780; d. New York, 31 May 1858. He was a brother of John Duer (q.v.). He was admitted to the bar in 1802, and between 1814 and 1820 was a member of the State assembly, taking a prominent part in the debates on the establishment of canals and other important questions. In 1822 he was appointed judge of the Supreme Court in the third circuit, an office which he held until the close of 1829, when he was elected president of Columbia College. He retired from this post in 1842. He was the author of a treatise on the 'Constitutional Jurisprudence of the United States'; and also 'Life of William Alexander, Earl of Sterling' (1847); 'Reminiscences of an Old New Yorker' (1867).

DUERO. See DOURO.

DUEZ, dü'ā, **Ernest,** French painter: b. Paris, 8 March 1843; d. there, 5 April 1896. He was a pupil of Pils, and his paintings include 'The Honeymoon'; 'Splendor and Misery'; 'Saint Cuthbert'; 'Evening in Villerville'; 'The Pont-Neuf'; and 'In Summer.' He painted some excellent portraits also. His work is realistic and colorful.

DUFAURE, dü'fōr, **Jules Armand Stanislas,** French orator and statesman: b. Saujon, France, 4 Dec. 1798; d. Paris, 28 June 1881. He practised law at Bordeaux; entered the Chamber of Deputies in 1834, and became an influential leader of the Liberal party. Under the Republic he was Minister of the Interior, but was driven from the public service by the *coup d'état* of 1851, and for the next 20 years devoted himself closely to his bar practice and pamphlet writing. Under the government of Thiers he acted as Minister of Justice; and in 1876, and again from 1877 to 1879, he was head of the Cabinet.

DUFF, Alexander, Scottish missionary: b. Perthshire, 26 April 1806; d. Edinburgh, 12 Feb. 1878. He set out in 1829 for India as the first Church of Scotland Missionary to that country. He opened a school in Calcutta in which he sought to teach not only the doctrines of Christianity, but also the English language and the science and learning of Europe. He subsequently assisted in founding the University of Calcutta. His chief writings are 'The Church of Scotland's India Mission' (1835); 'Vindication of the Church of Scotland's India Mission' (1837); 'India and India Missions' (1840);

'The Jesuits' (1845); 'The Indian Mutiny: Its Causes and Results' (1858).

DUFF, Archibald, English biblical scholar: b. Fraserburgh, Aberdeen, 1845. He was educated at McGill University and Andover Theological Seminary, also at Halle and Göttingen, Germany. In 1864–69 he was a high-school teacher in Canada and in 1875–78 was theological tutor and mathematical tutor in Montreal; in the latter year he was appointed professor of Hebrew and Old Testament theology in the United College, Bradford. He was chairman of the Yorkshire Congregational Union in 1893, was one of the founders of the Athenæum Club and coeditor of *Bibliotheca Sacra* from 1874 to 1894. His publications include 'The Use of the Old Testament in the Study of Origin of Doctrine' (1879); 'The History of Atonement Among the Hebrews' (1880); 'Old Testament Theology' (Vol. I, 8th Century B.C., 1891; Vol. II, Deuteronomic Reformation, 1900); 'Hebrew Grammar' (1901); 'Theology and Ethics of the Hebrews' (1902); 'First and Second Esdras' (in "Temple Apocrypha," 1903); 'Abraham and the Patriarchal Age' (1903); 'Modern Old Testament Theology' (1908); 'History of Old Testament Criticism' (1910); a translation of Duhm's 'Ever-coming Kingdom of God' (1911); and of 'Book of the Twelve Prophets' (1912); 'Isaiah' and Frenssen's 'Story of Jesus' (in "Brother Richard's Bookshelf," 1913); and commentaries on Esther and Lamentations.

DUFF, Edward Gordon, English librarian: b. 16 Feb. 1863. He was educated at Cheltenham College and Oxford and was librarian of the John Rylands Library, Manchester, 1893–1900. He was Sandars reader in bibliography in Cambridge University 1898–99 and 1903–04, 1910–11. He has published 'Early Printed Books' (1893); 'Early English Printing' (1896); 'The Printers, Stationers and Bookbinders of London' (1899); 'William Caxton' (1902); 'A Century of the English Book Trade' (1905).

DUFF, Sir Mountstuart Elphinstone Grant, English writer and politician: b. Eden, Aberdeenshire, 21 Feb. 1829; d. London, 12 Jan. 1906. He was educated at Balliol College, Oxford, was called to the bar of the Inner Temple in 1854 and in 1857 entered the House of Commons as a Liberal. From 1868 till 1874 he held the office of under-secretary for India under Mr. Gladstone, and in that statesman's second ministry he was under-secretary of the colonies from 1880 till his appointment in 1881 as governor of Madras. His tenure of this important office was very successful and ended with his resignation in 1886. From 1889 till 1893 he was president of the Royal Geographical Society. His published works include 'Notes of an Indian Journey' (1876); 'Miscellanies, Political and Literary' (1878); 'Memoir of Sir Henry Maine' (1892); 'Ernest Renan' (1893); 'Notes from a Diary' (1897–1900); 'Out of the Past' (1903); 'Gems from a Victorian Anthology' (1904).

DUFFERIN, dŭf'fẽr-ĭn, **AND AVA,** ä'vą, **Frederick Temple Hamilton-Temple Blackwood,** Marquis of, Irish diplomatist and author: b. Ireland, 21 June 1826; d. Clandeboye, Ireland, 12 Feb. 1902. On the death of his father in 1841 he succeeded to the title of Baron of Dufferin and Clandeboye in the peerage of Ireland. He first distinguished himself by contributions to literature and published the popular 'Letters from High Latitudes' in 1859. He was successively under-secretary for India 1864–66 and for war 1866, was chancellor of the duchy of Lancaster 1868–72, in 1871 was created an earl and was governor-general of Canada 1872–78. His brilliant administration was remarkable for the wonderful development of the provinces and the beginning of construction of the Canadian Pacific Railway. From 1879 to 1881 he was Ambassador at Saint Petersburg, whence he was transferred to Constantinople. In 1884 he succeeded Lord Ripon as viceroy of India, resigning in 1888. Lord Dufferin's tenure of office was made memorable by measures for strengthening the Indian frontier, by the various attempts to delimit the Afghan frontier and, above all, by the annexation of Upper Burma in December 1885. He became successively Ambassador at Rome, marquis (1888) and Ambassador to France (1891–96). In addition to the volume named he published 'Irish Emigration and the Tenure of Land in Ireland' (1867); 'Speeches and Addresses' (1882); 'Speeches Delivered in India' (1890). His mother, Helen Selina Sheridan (1807–67) was the author of 'The Emigrant's Farewell,' 'O Bay of Dublin' and other touching songs.

DUFFIELD, George, American Presbyterian clergyman and hymn writer: b. Carlisle, Pa., 12 Sept. 1818; d. Bloomfield, N. J., 6 July 1888. The son of a well-known pastor, he was graduated at Yale in 1837 and at Union Theological Seminary, New York, in 1840. He held various Presbyterian pastorates and wrote the popular hymns 'Blest Saviour, Thee I Love' (1851), and 'Stand Up, Stand Up for Jesus' (1858).

DUFFIELD, William Ward, American civil engineer: b. Carlisle, Pa., 19 Nov. 1823; d. 1907. He was graduated at Columbia in 1841 and served as lieutenant on the staff of General Pillow in the Mexican War 1847–48, and during the Civil War commanded the 4th Michigan Infantry. He was brevetted major-general in 1863, elected State senator for Michigan in 1878, and appointed chief engineer for railways in Michigan, New York, Illinois, Texas; and United States engineer of improvements on Wabash and White rivers in 1892. In 1894–98 he was superintendent of the United States Coast and Geodetic Survey. In the survey 'Report' for 1895–96 he published a valuable table of 10-figure logarithms to 100,009, newly calculated. His writings include 'School of the Brigade, and Evolutions of the Line'; 'Treatise on Logarithms.'

DUFFY, Sir Charles Gavan, Australian statesman: b. Monaghan, Ireland, 12 April 1816; d. Nice, France, 9 Feb. 1903. He took to journalism and in 1842 assisted in founding a Dublin newspaper called the *Nation*. In 1843 he was convicted of sedition with O'Connell, but the House of Lords in the following year quashed the conviction. He played a prominent part in the founding and directing of the Irish Confederation and in 1848 he was brought to trial along with other members of that body on a charge of treason-felony, but the prosecution could not obtain a conviction. In 1852 he was elected to Parliament as representative of New Ross and

succeeded in forming an independent Irish political party. Dissensions arose, and in consequence he resigned his seat and went to Australia in 1856. For some time he practised as a barrister in Melbourne. In 1857 he became Minister of Public Works in the first responsible Victorian government. In 1858 and again in 1862 he was Minister of Lands and became Premier of Victoria in 1871. In 1880 he returned to Europe. Several works from his pen have been published, including 'The Ballad Poetry of Ireland' (1845, about 50 editions); 'Young Ireland: a Fragment of Irish History 1840–50' (1880); 'Four Years of Irish History 1845–49' (1883), a sequel to the preceding work.

DUFRENITE, dū'frĕn-īt, a native basic phosphate of iron. It occurs in small crystals of orthorhombic form, but usually it is in radiating-fibrous masses, sometimes with botryoidal or drusy surface. Its hardness is 3.5 to 4 and specific gravity about 3.3. It is nearly opaque, has a silky lustre and blackish-green color. It is found in Westphalia, Bohemia, France and in East Cornwall, England. In the United States it occurs as a fibrous coating in the Green Sand formation at Allentown, N. J.; also in coarse greenish-brown radiating masses underlying layers of lignite in Rockbridge County, Va. It was named in honor of the French mineralogist Dufrenoy.

DUFRESNE, Charles, shärl dü-frān. See DU CANGE.

DUFRESNY, dü-frā-nē, **Charles Rivière,** French poet: b. Paris 1654; d. there, 6 Oct. 1724. He was appointed manager of the royal gardens on account of the strong love of flowers which he manifested, and in this capacity introduced into France the taste for gardens in the English style. Among his dramatic pieces may be mentioned 'L'esprit de contradiction,' a one-act play in prose; 'Le mariage fait et rompu,' in verse; and a second prose piece in three acts, called 'Le double veuvage.' He also wrote a romance in which he depicts the manners of the time after the fashion of Le Sage, 'Les amusements sérieux et comiques.'

DUGAS, Louis Alexander, American physician: b. Washington, Ga., 3 Jan. 1806; d. 1898. His parents were of French ancestry and emigrated from Santo Domingo. He was educated at home, studied medicine with Dr. John Dent, and in 1827 was graduated at the medical department of the University of Maryland. After attending lectures in Baltimore and Philadelphia, and spending several years in study in Europe, he settled in Augusta, Ga., in 1831. In 1832 he united with five others in founding the Medical College of Georgia, in which he was for many years professor of surgery. In 1869 the degree of LL.D. was conferred upon him by the University of Georgia. For many years he was president of the Medical Society of Augusta and president of the Medical Association of Georgia. During the Civil War he was volunteer and consulting surgeon of military hospitals. From 1851 to 1858 he was editor of the *Southern Medical and Surgical Journal.* His works include 'Rheumatism'; 'Ophthalmia'; 'Colica Pictonum'; 'Convulsions'; 'Surgical Operations during Mesmeric Insensibility'; 'Use of Quinine in Fevers'; 'Diagnosis of Shoulder Dislocations'; 'Fractures of the Scapula'; 'Transactions of the Medical Association of Georgia'; 'Pathological Peculiarities of Negroes.'

DUGDALE, SIR **William,** English antiquary: b. Shustoke, Warwickshire, 12 Sept. 1605; d. there, 10 Feb. 1686. He was, in 1640, made *rouge croix pursuivant,* and had apartments in the heralds' office, with ample opportunities for his favorite study. With Dodsworth he prepared the 'Monasticon Anglicanum' (1655–73). The principal work of which Dugdale had the sole merit is the 'Antiquities of Warwickshire' (1656). At the Restoration he was appointed Norroy king-at-arms, and in 1677 Garter king-at-arms, with the honor of knighthood. Besides the works already mentioned, he published the 'Baronage or Peerage of England' (1675–76); 'Origines Judiciales, or Historical Memoirs of the English Law Courts of Justice, etc.' (1666); a 'History of St. Paul's Cathedral' (1658); and various minor writings. His manuscripts are preserved in the Bodleian Library, the Heralds' College and some in the Ashmolean Museum.

DUGMORE, Arthur Radclyffe, American artist and author: b. England, 25 Dec. 1870. He studied painting at the Belle Arti, Naples; came to the United States in 1889, and has devoted himself to the study of ornithology, drawing, painting and illustrating by photography. He exhibited his paintings in London 1913, and lectured in the United States and England 1911–14. In 1914 he went to Belgium to investigate conditions of German warfare against the Belgians. He was taken prisoner by the Germans, but was afterward released. He was made lieutenant of the British army, March 1915, and was wounded at the battle of Alost. He has published 'Bird Homes'; 'Habits of the Land Birds Breeding in the Eastern United States' (1900); 'Nature and the Camera' (1902); 'Camera Adventures in the African Wilds' (1910), which contains his experiences (many of them extremely hazardous) in photographing African big game; 'Wild Life and the Camera' (1912); 'Romance of the Newfoundland Caribou' (1913), in which he gathered the results of nine seasons of patient and successful camera hunting of that wary animal; 'Romance of the Beaver' (1914).

DUGONG, dū'gŏng, or **DUYONG,** the Malayan name for the genus *Halicore* of the order *Sirenia* or «sea cows.» It is from five to seven feet long, occasional specimens attaining a length of nine feet. It is a marine animal, never ascending rivers, and feeds chiefly on seaweed; in which particular it differs from the related genus *Manatus.* It is found along the shores of Australia, of the Indian Ocean and around the Red Sea. Unlike the manatee it has a crescent-shaped tail, its nostrils are on the upper part of the muzzle and its flippers are quite without trace of nails. The skull of the dugong is characterized by the thickness of the beak and the lower jaw, both of which are bent sharply downward, almost at right angles to the axis of the skull. In the males the incisors are developed into large, straight tusks, pointing directly downward. In color the animal is grayish-blue, sometimes whitish below. The female is proverbial among the Malays for her maternal solicitude for her offspring, of which

but one is produced at a birth. And this is supposed to be one of the sources of the mermaid legend.

The flesh of the dugong is said to be extremely palatable; but its chief value, from a commercial standpoint, is the fine oil yielded by the Australian species (*Halicore australis*). This has been in such demand for medicinal and other purposes as to have caused a wholesale slaughter amounting almost to the extermination of the species. See SIRENIA for structure.

DUGOUT, a cave dug in the side of a hill or mountain, used as a dwelling, partly built of logs as seen in some sections of Montana, or as a place of refuge from cyclones and tornadoes. These are frequently to be seen in some of the Western States. Also the name of a canoe or boat made from a log of wood, hollowed and shaped for use.

In military usage, a dugout is an artificial cave used for the purpose of cover from shells. It is either hollowed out and propped up from within, or is dug from the surface of the earth, and then covered with layers of earth and broken stone supported on a framework of steel rails. See FORTIFICATIONS.

DUGUAY-TROUIN, dü-gā-troo-ăn', **René,** French seaman: b. Saint Malo, 10 June 1673; d. Paris, 27 Sept. 1736. His various successful privateering expeditions attracted the attention of the government before he was 21, and Louis XIV sent him a sword. He captured great numbers of English and Dutch ships on the coast of Spain and Ireland; in 1696 he took a great part of the outward-bound Dutch fleet under Wassenaer; in 1697 he entered the royal marine as a captain. He signalized himself so much in the Spanish war that the king granted him letters of nobility, in which it was stated that he had captured more than 300 merchant ships and 20 ships of war. By the capture of Rio de Janeiro (1711) he brought the Crown more than 25,000,000 francs. Louis XIV made him lieutenant-general and placed him in command at Brest. Under Louis XV he rendered important services in the Levant and the Mediterranean.

DU GUESCLIN, dü gā-klăn, **Bertrand,** constable of France: b. Motte-Broon castle, near Rennes, 1320; d. 13 July 1380. He served first in the army of Charles of Blois (1342). He was knighted in 1354. Mainly to him must be attributed the expulsion of the English from Normandy, Guienne and Poitou. He was captured by Chandos at the battle of Auray in 1364, and ransomed for 100,000 francs. While serving in Spain against Peter the Cruel he was made prisoner by the English Black Prince, but was soon liberated. For his services in Spain he was made constable of Castile, Count of Trastamare and Duke of Molinas; and in 1370 he was made constable of France. In 1373 he occupied most of the fortresses of Brittany and died at the siege of Châteauneuf de Randon. Consult Luce, 'Histoire de Bertrand du Guesclin et de son epoque' (1876); Stoddard, 'Bertrand Du Guesclin' (1897).

DUHM, Bernhard Laward, German Protestant biblical scholar: b. Bingum, Hanover, 1847. He received his education at Göttingen, where he taught from 1877–89. In the last-named year he went to Basel in the capacity of professor of Old Testament theology. He is especially noted for his brilliant biblical criticisms. His works include 'Theologie der Propheten' (1875); 'Über Ziel und Methode der Theologie' (1889); 'Kosmologie und Religion' (1892); 'Das Geheimnis in der Religion' (1896); 'Die Entstehung des Alten Testaments' (1897–1906); 'Das kommende Reich Gottes' (1909, translated into English by Duff, 1911); translations in the original metre of 'Job' (1897); the 'Psalms' (1899); 'Jeremiah' (1903); 'Habakkuk' (1906); and commentaries on these books and on the 12 minor prophets.

DÜHRING, dü'rĭng, **Eugen Karl,** German philosophical writer; b. Berlin, 12 Jan. 1833. He studied at the University of Berlin, and practised law for a time; he then became professor of philosophy and political economy at Berlin in 1864, but gave up the position on account of quarrels with the faculty. He has written 'Der Wert des Lebens' (1865), which did much to introduce the positivism of Comte into Germany; 'Kritische Geschichte der Philosophie' (1869); 'Logik und Wissenchaftstheorie' (1878); 'Die Judenfrage als Rassen-, Sitten-, und Kulturfrage' (1892); also a number of works in political economy, including 'Kapital und Arbeit' (1865) 'Die Verkleinerer Careys' (1867); and 'Kritische Geschichte der Nationalökonomie und des Sozialismus' (1879). Consult Döll, 'Eugen Dühring' (1883).

DUIKER-BOK, dī'kėr- or doi'ker-bŏk, a genus of small antelopes (*Cephalolophus*), native to southern Africa. They are characterized by small, straight horns, generally present in both sexes; and by an upright tuft of hair between the horns. The typical species (*C. grimmi*) is found in bush-covered districts from the Cape of Good Hope to the Zambesi River, and ranges even farther north along the west coast of Africa. It stands about 26 inches high; its ears are long and narrow; its color is yellowish-brown, with a tendency to gray; but the color is decidedly variable. The horns, in this species present only in the male, are from three to five inches long, and rise at a sharp angle to the face. Of the allied species the following are the most important: The redbuck of Natal (*C. natalensis*), which differs from *C. grimmi* in that its horns incline backward, and are present in both sexes; and that its color is more reddish. The bluebuck of the jungle (*C. monticola*) is a tiny creature, only 13 inches high at the shoulder, that swarms in the Natal region. It is smaller and lighter in build than a hare; is bluish mouse-color, and has tiny straight horns. It feeds on berries and young shrubs. The zebra-antelope of West Africa (*C. doriæ*) is distinguished by its coat of rich golden-brown, banded with eight or nine transverse lines across the back loins. The wood antelopes, also West African, are nearly three feet tall, and are classed in two species, *C. sylvicultor* and *C. jentinki*.

The name «duiker» signifies «ducker» or «diver,» in allusion to the animal's rapidity of motion when in the thickets. Consult Schweinfurth, Heart of Africa' (Leipzig 1878); and other books by African explorers and naturalists.

DUILIUS, Gaius, Roman general: b. about 300 B.C. He was trained to arms by his father, Marcus and rose to the highest rank as a naval and military officer. He became consul in 260 B.C., defeating the Carthaginians near Mylæ in that year. In honor of this victory, Rome's first success on the sea, a magnificent column (columna rostrata) was erected.

DUISBURG, doo'is-boorg, Germany, city, an inland port of Prussia, in the Rhine province, about 13 miles north of Düsseldorf. The town has civic, educational and other institutions in keeping with its importance. The finest of the churches is the 14th century Saint Salvator, with fine wall-paintings. Duisburg has blast-furnaces, foundries and other works depending on the iron trade. Its chemical works, cotton-mills and commerce are extensive. It is an ancient place, early rose to be a free town, and became a member of the Hanseatic league. It possessed a university from 1655 to 1818. The tomb of Mercator, the famous geographer, is here. Pop. about 93,600.

DUJARDIN, dü-zhär-dăn, **Félix,** French naturalist: b. Tours, 5 April 1801; d. Rennes, 8 April 1860. From 1827 to 1834 he delivered public lectures in Tours upon geometry and chemistry as applied to the arts. During the same period he published several geological works, in one of which he first made known the curious fact that artesian wells bring to the surface seeds and remains of insects, which have been taken from long distances and transported through subterranean passages. In 1833 and 1834 he published descriptions of the flora of the region of the Loire, and of the geology and fossils of Touraine. He then devoted himself to zoological researches, and published observations upon the *rhizopodæ,* for which he proposed a new classification. In 1839 he added extended annotations to the 3d volume of De Lamarck's 'History of Invertebrate Animals,' and among his later publications were his researches upon the brain of insects, and upon the instinct of bees. He was a professor at Rennes from 1839.

DUJARDIN, Karel, Dutch artist: b. Amsterdam 1640; d. Venice, 20 Nov. 1678. He went to Italy when young, and was a member of the Society of Painters at Rome, among whom he was called BARBA DI BECCO. His works met with general approbation. His landscapes have spirit and harmony, his figures expression and his color the brilliancy which distinguishes his school. His paintings are rare and command a high price. He also published 52 landscapes etched with much spirit and ease. The Louvre possesses his masterpiece 'The Charlatans.' Amsterdam, Brussels, Berlin and the National Gallery, London, have specimens of his work.

DUK-DUK, in New Britain (formerly New Pommern)—the largest island of the Bismarck archipelago in the Pacific Ocean—is a secret male society for the preservation of ancient observances among the Melanesian natives. The inculcation of respect and order among the youthful members of the community, the subjection of women and the enforcement of obedience to the chiefs are among its main objects; its mystic ceremonies, masked dances, etc., are picturesque. The society is analogous to the West African negrital Mumbo Jumbo organizations, and is interesting sociologically as an uncivilized form of the *Vehmgerichi,* lodges, bachelors' clubs, etc., of Europe and America. Consult Powell, 'Three Years Among the Cannibals of New Britain' (1897).

DUKE, Basil Wilson, American lawyer and famous cavalry leader in the Confederate army: b. Scott County, Mo., 28 May 1838; d. New York, 16 Sept. 1916. He was educated at Georgetown (Ky.) College and Danville College and the Lexington Law School. Before he had reached his majority General Duke was active in the group of men who fought to carry Missouri into the Confederacy. He was born in Scott County, Ky., in 1838, but saw his first military service in Missouri. Returning to Kentucky, he joined his brother-in-law, Gen. John H. Morgan, in raising troops for the Southern Army. From a lieutenant in the famous cavalry organization known as "Morgan's Raiders," he rose rapidly to the rank of colonel and led one of the hardest fighting cavalry regiments in the service. He was badly wounded at the battle of Shiloh, but recovered in time to participate in the operations of Morgan's troops in Tennessee and Kentucky, being present at the famous Ohio raid. With his chief and most of the command he was captured and imprisoned in the Ohio penitentiary, from which General Morgan dug his way to freedom with most of his men. He frequently distinguished himself for gallantry and the unusual success of the military operations he directed, and gained a reputation for daring second only to that of the noted cavalry leader with whom he was associated for the full period of the rebellion.

For more than 20 years Brigadier-General Duke was connected with the law department of the Louisville and Nashville Railroad, with headquarters at Louisville. He was the author of many books on finance and the Civil War, among the latter being the 'History of Morgan's Cavalry' (1867) and 'Reminiscences of Gen. Basil W. Duke' (1911). He also wrote the 'History of the Bank of Kentucky.'

DUKE, James Buchanan, American tobacco manufacturer: b. on farm near Durham, N. C., 1857. He was educated in the country schools; entered the tobacco business with his father and brothers at Durham under the firm name of Duke Brothers and Company. In 1884 he went to New York and in 1889 organized the American Tobacco Company of which he was president until 1912. He is president of the Continental Tobacco Company and the Consolidated Tobacco Company and since 1912 chairman of the board of directors of the British-American Tobacco Company. He is a director of the Imperial Tobacco Company and of many other corporations.

DUKE (in French *duc,* in Spanish *duque,* in Italian *duca,* in Venetian *doge,* all derived from the Latin *dux,* leader, commander), a title belonging originally to a military leader. It seems to have come into use when Constantine separated the military and civil commands of the provinces; the title *dux* was then applied to the military governor of a province, and the ducal rank was made inferior to that of the *comes* (count). The Goths, Franks and other

northern tribes who invaded the vast Roman territories, adopted, if they had not before borrowed, the titles of duke and count. Among those warlike peoples, however, the dukes as military chiefs soon acquired a marked pre-eminence over the counts, whose functions in the eastern and western empires were more of a civil and judicial nature. Under Charlemagne, who was jealous of the increasing power of the higher nobility, the dignity was suffered to cease, but under his weaker successors the ducal governors of the provinces attained an almost absolute independence. The concession of hereditary power and independent jurisdiction, first to the central province known as the Isle de France, and then to Aquitaine, extended itself under the Carlovingians to Burgundy, Normandy and Gascony, and on the accession of Hugh Capet to all the other subaltern tenures. It was not long until the dukes, feeling secure in the unlimited governing power of their provinces, proclaimed their title to be as good as that of the king. They coined money, assumed the crown and sceptre, gave law to their subjects, made war even against the king and reduced the royal jurisdiction to a few towns such as Rheims and Laon. From the time of Philip II (Philippe Auguste) to that of Louis XI, however, these duchies were gradually reunited to the crown, and those subsequently accorded to the members of the royal family enjoyed none of the privileges of independent sovereignty. Prior to the Revolution dukes were created by letters patent of the king, and were of three kinds; those designated as dukes and peers held the first rank and had a seat in Parliament. The dignity of the second class descended to their male children, but that of the dukes by brevet ceased with themselves. The rank of duke in the royal family of France was superior to that of prince, and sometimes inferior to that of count. The ducal along with all other titles of nobility was abolished at the Revolution, but was restored by Napoleon in 1806.

In Germany the dukedom passed through phases similar to that exhibited in France. In 847 the Emperor Louis appointed a duke (Herzog) of Thuringia to protect the frontiers against the Wendes, or Vandals, a Slavonic tribe. The power of the dukes gradually increased, their dignity became hereditary and they soon became powerful members of the Holy Roman Empire. An archbishop of Cologne, Bruno, was the first who bore (in 959) the title of archduke (Erzherzog), which since the time of the Emperor Frederick III (1453) has been given exclusively to the princes of the house of Austria. All the Austrian princes are archdukes, as distinguishing title of the imperial family.

In Great Britain the title of duke ranks as a title of honor or nobility next below that of a prince or princess of the royal blood and that of archbishop of the Church of England. The first hereditary duke in England was the Black Prince, created by his father, Edward III in 1336. The duchy of Cornwall was bestowed upon him, and was thenceforward attached to the eldest son of the king, who is considered a duke by birth. The duchy of Lancaster was soon after conferred on his third son, John of Gaunt, and hence arose the special privileges which these two duchies still in part retain. Richard II was the first sovereign to make creations apart from princes of the royal house. Henry VIII and Edward VI made creations; but through attainders and failure of issue by the reign of Elizabeth in 1572 the ducal order became extinct, and was not revived till the creation of Villiers, Duke of Buckingham, and Ludovic Stuart, Duke of Richmond, by James I. Charles II bestowed dukedoms on six of his illegitimate children — those of Monmouth, Grafton, Northumberland, Southampton, Richmond and Saint Albans. By William, Anne and George I lower dignities were advanced to the rank of duke — of the 26 dukes of the British peerage exclusive of those of royal blood, only two, those of Norfolk and Somerset, were created prior to the Civil War. The coronet of a British duke consists of eight strawberry leaves of a conventional type on a rim of gold. In the Bible the word *dukes* is used, Gen. xxxvi, 15, for the *duces*, of the Vulgate.

DUKE OF EXETER'S DAUGHTER, a rack in the Tower of London, so-called after its inventor, a minister of Henry VI. According to Blackstone it was never put in use.

DUKE'S LAWS, so named from the Duke of York, afterward James II, were a code promulgated by Col. Richard Nicolls, the English commander who took New Amsterdam from the Dutch in 1664 and became governor of the colonies under the Duke's patent. They applied first to the Dutch; confirmed the patroons in their estates, which thenceforth were to be called manors; introduced jury trial; amended the criminal code, and provided for freedom of religion and equal taxation and militia service. There was no popular election of magistrates at first, but the code was afterward modified into the instrument of government of New York and New Jersey.

DUKES, Leopold, Hungarian scholar: b. Pressburg, 27 Jan. 1810; d. Vienna, 3 Aug. 1891. He spent the greater part of his life in research work in Jewish literature, fully 20 years being passed in the Bodleian Library and the British Museum. His books, largely of a critical character, threw new light on mediæval Hebrew literature, Hebrew grammarians and lexicography. He was also a frequent contributor to English, German and Hebrew publications. Among his works the most entertaining was his 'Rabbinische Blumenlese,' a collection of rabbinical proverbs and their illustrations from the popular sayings of other races. He was at his best in his sketches of the Hebrew poets of the Middle Ages, Moses ben Esra and Ibn Gabirol in particular. He translated into German (1838) the famous Pentateuch commentary of Rashi.

DUKHOBORS, doo-kō'bôr, **DUKHOBORTSY.** See DOUKHOBORS.

DUKINFIELD, England, a borough in county of Chester, a few miles from Manchester. Extensive collieries, cotton factories, engineering, brick and tile works give employment to the greater part of the population. Pop. about 19,500.

DULAG, doo'läg, Philippines, a town on the eastern coast of the island of Leyte, at the mouth of the Catbassag River. There are large

deposits of sulphur in the vicinity. Pop. about 15,000.

DULANGAN, doo-län'gän, or **GULANGAN,** a heathen tribe of the Philippines, living in the southern part of the province of Davao, island of Mindanao. It is uncertain whether they are of pure Malayan race or have an infusion of Negrito blood.

DULANY, Daniel, American colonial lawyer: b. Annapolis, Md., 1721; d. 1797. He was educated in England, at Eton, Cambridge and the Temple, and was admitted to the bar of Maryland in 1747. He was deputy commissary-general from 1754 to 1761 and a member of the provincial council from 1757 to 1775. He also served as deputy secretary and secretary of Maryland from 1761 to 1773. In 1765 he wrote a powerful pamphlet against the Stamp Act, and his arguments against arbitrary taxation furnished material for Pitt's famous speech on behalf of the American colonies in 1766. He was, however, a staunch Royalist, refused to take part in the Revolution and lost nearly all his landed property by confiscation. Consult Tyler, 'Literary History of the American Revolution' (New York 1897).

DULCAMARA. See BITTER-SWEET.

DULCAMARIN (picroglycion or dulcarin, $C_{32}H_{54}O_{16}$) a glucoside which is separated from the aqueous extract of *Solanum Dulcamara*— bitter-sweet, and consists of a yellow, transparent, resinous, easily powdered mass, readily soluble in alcohol, sparingly in ether, and very slightly in water. It has a slight alkaline reaction and yields to platinum salt. The narcotic alkaloid solanine is also obtained from bitter-sweet.

DULCE, dool'sā. (1) A lake of Guatemala, on the east coast, 100 miles northeast of Guatemala City, communicating with the Gulf of Honduras by the lakelet el Golfete. It is about 30 miles long by 12 broad and from 20 to 60 feet deep. Also called Lake Izabal, it is the chief waterway of the state to the Caribbean Sea and the Atlantic Ocean. (2) A river in Argentina, rising in the province of Tucuman, and called in its lower course the Saladillo River. It flows northeast past Santiago and ends in the salt marshes of Lake Porongos. (3) A gulf on the coasts of Costa Rica and Panama, in Central America.

DULCE DOMUM, a famous song sung at Winchester College, England, on the eve of the break-up day for the summer holidays. The origin of both words and music is very uncertain — it is usual to ascribe the former to one Turner, probably him who became bishop of Ely, and was one of the seven bishops under James II; the latter, to Johannes Reading, organist of the college from 1681 to 1689.

DULCIGNO, dool-chēn'yō, Montenegro, a small seaport town on the Adriatic. The inhabitants, formerly notorious under the name of *Dulcignottes,* as the most dangerous pirates of the Adriatic, are now engaged in commerce or in the fisheries of the river Bojana. Pop. 5,102.

DULCIMER, an ancient musical instrument used by various nations, and, in shape and construction, having probably undergone fewer changes than any other instrument. In its earliest and simplest form it consisted of a flat piece of wood, on which were fastened two converging strips of wood, across which strings were stretched tuned to the natural scale. The only improvements since made on this type are the addition of a series of pegs, or pins, to regulate the tension of the strings, and the use of two flat pieces of wood formed into a resonance-box, for the body. The German name, *Hackbrett* (chopping-board), points to the manner in which it was played, the wires being struck by two hammers, one held in each hand of the performer. The fact which makes the dulcimer of the greatest interest to musicians is that it is the undoubted forefather of our pianoforte. A modern grand pianoforte is, in reality, nothing more than a huge dulcimer, the wires of which are set in vibration by keys. It probably came from the East, brought by the Crusaders.

DULCINEA DEL TOBOSO. The idealized peasant girl whom Don Quixote gives the romantic name (meaning sweetheart or lady-love), but who is commonly known as plain Aldoriza Lorenzo. The hero of Cervantes' novel adores this humble girl of Toboso madly and becomes her champion.

DULLER, Eduard (1809–53), a German historian, theologian and poet, born and educated in Vienna, who had both literary and ecclesiastical ambitions. Before he was 19, he wrote a religious drama, 'Meister Pilgram,' which was successfully performed. He took a prominent part in the German Catholic movement, strenuously espousing the cause of religious liberty. Besides several distinctly literary productions and contributing the libretto to Mangold's opera of 'Tannhäuser,' Duller published these standard historical works: 'Vaterländische Geschichte,' 'Geschichte des Deutschen Volks' and 'Geschichte der Jesuiten.'

DULONG, Pierre Louis (1785–1838), French scientist whose name is associated with the law in physics known as the law of Dulong and Petit. Dulong was educated at the Ecole Polytechnique. Afterward (1820) he was made professor of physics at the same institution. In 1819, in conjunction with Petit, another French physicist, Dulong discovered the law that the specific heat of an element, multiplied by its atomic weight, is the same for all solid elements. Although this law has been verified again and again, it has yet to receive a theoretical explanation. In recognition of his scientific achievements, Dulong (in 1823) was admitted into the Academy of Sciences. He lost an eye while experimenting in his laboratory.

DULSE, an edible seaweed growing on rocky seacoasts. In the British Isle dulse is a cheap article of food; elsewhere it is rather expensive and even a luxury. The name is also applied to another seaweed found in the southwest of England, which is also sometimes employed as a food. Still a third brand of dulse is found in Alaska.

DULUTH, Minn., city and lake port, seat of Saint Louis County and third largest city of the State, is favorably situated at the extreme western end of Lake Superior. The scythe-like projection called Minnesota Point, with a similar peninsula from the Wisconsin shore, forms a harbor for the city and its twin

port, Superior (Wis.), 19 miles square with a shore line of 49 miles. This fine harbor is entered by two channels, one, natural, near the Wisconsin shore, the other, a canal, 250 feet wide, piercing Minnesota Point. The broad mouth of the Saint Louis River, nearly enclosed by other points of land, forms an excellent inner harbor. Federal improvements to the value of $7,500,000 have deepened the harbor from 9 to 22 feet and made 17 miles of channels 22 feet deep and 200 to 600 feet wide. Overlooking the river, harbor and lake from steep and picturesque slopes, the city of Duluth stretches from the old Astor trading-post at Fond du Lac northeastward for more than 20 miles.

Improvements and Buildings.— The city owns its own waterworks and gas distributing system which it values at $4,756,218. It has 85 miles of paving and 186 miles of sewers. The city has profited by the beauty of its surroundings in its parking and boulevarding, having laid out spacious grounds along the banks of the several mountain streams that enter the lake at this point, and made roadways that command views of the lake and countryside. Altogether it possesses 21 miles of these drives, the most notable of which is Rogers Boulevard that follows a most interesting course of 12 miles. There are 442 acres of parks including Lester, the largest, Congdon and Chester; and in addition there are eight playgrounds. The Duluth-Superior Street Railway reaches all parts of the city and Superior, Wisconsin, using the Interstate Bridge. It has 60 miles of track. Among the buildings that are noteworthy are the Central High School, Carnegie Library, Courthouse, Pilgrim (Congregational) Church, Darling's Observatory, the National Guard and Naval Militia Armory, Kitchi Gammi Club, Aldworth Building and Soo Line Station.

Recreation Facilities.— Duluth is a favorite resort for tourists because of the variety of outings it suggests. Excursion steamers make regular trips to Fond du Lac and to Isle Royale, and other Lake Superior resorts. The Duluth Boat Club, with 2,000 members, has a high reputation for sportsmanship. There is abundant fishing both for Lake Superior and inland varieties. The curling rink has a capacity of 6,000 curlers and skaters; and the ski hills attract thousands annually. Other attractions for the visitor are the incline railway up the bluff 800 feet high that overlooks the centre of the city and the aerial bridge over the steamer channel through Minnesota Point.

Education.— Duluth has 41 school buildings, including two high schools and three junior high schools. These buildings are valued at $3,533,218. In the system are enrolled 17,000 pupils. A state normal school located here enrolls 400 students annually. The Roman Catholics support Villa Scholastica and also a training school for nurses in Saint Mary's Hospital; and the Episcopalians maintain a school for nurses in Saint Luke's Hospital. In the city there are 90 churches. The Duluth Carnegie Library and two branches circulated in 1916 236,166 volumes. The Duluth Bar Association has an extensive library.

Commerce.— The great advantage of possessing a fine harbor has made Duluth the second port in point of tonnage in the United States. In 1916 its outgoing tonnage of ore and grain equaled that of any two ports in the world. This tonnage has greatly increased during the past few years. In 1900 the total number of tons shipped and received was 14,387,058, and the total number of vessels arriving and departing was 11,334; in 1917 the tonnage was 52,177,333 and the number of vessels 12,445. Four hundred and ninety-nine vessels make Duluth their home port. Less than three hours' run from the Mesabi Range, the city receives iron ore in constantly increasing volume for shipment to mills at Chicago, Gary and Pennsylvania points. In 1916 this business amounted to 38,374,953 tons. Ore trains run directly to the docks from which they are dumped into pockets which in turn discharge into ore steamers. One of these docks is 2,300 feet long and 50 feet wide and contains 384 pockets. Usually it takes three hours to dump 10,000 tons. From the Red River Valley and the fields of Canada 65,072,940 bushels of grain were received at the Duluth elevators which have a capacity of 33,125,000 bushels; and from the forest country of northern Minnesota 146,892,000 feet of lumber. The district supplying these products depends on Duluth for its coal as also do the manufacturing plants of Minneapolis and Saint Paul, and other points to the south. In 1916, 9,585,337 tons of hard and soft coal were received at Duluth. The coal docks are equipped with electrically operated machinery so that 1,000 tons can be unloaded in an hour. The docks have a storage capacity of 10,000,000 tons. For the transportation of this and other commodities the city has ample railroad facilities. With the Minneapolis and Saint Paul it is connected by the Great Northern, Northern Pacific, Soo and the Chicago, Saint Paul, Minneapolis and Omaha; with North Dakota, Manitoba and Montana by the first three and the Canadian Northern; with the Mesabi Range by all of these, excepting the last, and by the Duluth, Mesabi and Northern. The Duluth and Iron Range connects the city with its subport, Two Harbors and with the Vermillion Range. The Duluth, South Shore and Atlantic and the Soo Line maintain service with eastern points; and both the Soo and the Chicago, Saint Paul, Minneapolis and Omaha make direct connection between Duluth and Chicago. The Chicago, Milwaukee and Saint Paul maintains a freight service between Duluth and the Twin Cities by arrangement with the Northern Pacific Company.

Manufacturing.— With its great commercial advantages the city has been enabled during the past 25 and especially during the past 10 years, to increase its manufacturing capacity very greatly. The largest plant is that of the Minnesota Steel Company (United Steel Corporation) in the western part of the city. It represents a capital of $25,000,000 and employs 4,000 men, for whom it has built a model city within the limits of Duluth. The Zenith Furnace Company produces coke tar and ammonia, as well as gas for lighting and heating the city. Duluth also has many establishments working in iron, a cement factory of importance, flour mills, sash factories, clothing establishments and steamboat works. In all it has 243 establishments employing 12,000 people and producing annually a value of $20,000,000, exclusive of the

value of the steel, of which $8,000,000 is added by manufacture. For this manufacturing there is available 120,000 horsepower of electric current from the Saint Louis River, of which 60,000 is already being utilized. The city is lighted by this power, the current being distributed by the Duluth Edison Electric Company at a maximum rate of 6 cents per kilowatt hour

Finance.— Duluth has 10 banks — 4 national and 6 State — with a capital and surplus of $7,000,000 and deposits of $30,000,000. Its clearings in 1916 were $283,812,916. Postal receipts were $440,097. Its assessed valuation is $58,596,674. The rate of taxation is 37 mills.

Government.— The government of Duluth has been a model for other cities. Five commissioners, each responsible for a single department of municipal activity, form a council under the presidency of the mayor, the commissioner of public safety. This department includes police, fire, health and harbor divisions. The commissioner for public affairs has charge of the library and welfare divisions; the commissioner of finance controls accounting and licensing; the commissioner of public works supervises the engineering, street improvement and construction of water and gas mains; the commissioner of public utilities is responsible for the water and gas systems. The commissioners acting as a council appoint the city clerk, assessor, attorney and auditor; but they themselves have appointive power within their own departments for all necessary employees. Through ownership of the gas distributing system the city has reduced the price from $1.90 to 75 cents a thousand cubic feet. The city is without saloons.

History.— Duluth has had an interesting history. Radisson and Grosilliers, French traders, passed the site of the city in 1659. In 1679 Daniel Greysolon Sieur Du Lhut visited the head of Lake Superior and became very friendly with the Dakota Indians, whose lands then extended into what was later the Chippewa Territory. He was able to buy 50 canoe loads of fur. Later he rescued Father Hennepin from a band of Dakotas, who had captured him while he, with companions, was on his way up the Mississippi after leaving La Salle's party, and rather badly treated him. It is fitting that the city bear the name of one of the most intrepid and capable of the many Frenchmen who had to do with the Northwest. When the French lost control of America other traders made their way over the site of Duluth to the upper Mississippi, journeying by the Saint Louis and portages to Sandy Lake. This route made a post at Fond du Lac very important. Early in the 19th century the American Fur Company, under the direction of William Astor, established a station there, one building of which is still to be seen. As late as 1860, however, what is called Duluth was a forest except for a few huts on Minnesota Point. The partial improvement of the harbor called attention to the possibilities of a city, but the country at large was much of the opinion of Senator Proctor Knott, who said in a speech that rather than vote for a grant of land for a railroad at Duluth he should prefer that "the freezing cyclones of the bleak Northwest bury it forever beneath the eddying sands of the Saint Croix." The Saint Paul and Duluth, now a part of the Northern Pacific system, arrived in 1870, and the Northern Pacific built through from Duluth to North Dakota in 1874. Later the establishment of better connection with the Minneapolis and Saint Paul and the discovery of iron in the Vermillion Range brought prosperity to the village. The first shipment from the Vermillion Range was made in 1884 from Two Harbors; the first shipment from the Mesabi was made in 1892. Since that date, with the exception of a brief period of depression following the panic of 1893, the progress of the city has been continuous.

Population.— In 1860 the total population of Saint Louis County, including Duluth, was 406. In 1870 this had increased to 3,131. In 1880 the population of the city was 3,483; in 1890, 33,115; in 1900, 52,969; in 1910, 78,466. In 1917 the estimated population was 97,000. The foreign-born population is 39 per cent of the whole, the leading nationalities being Scandinavian, 14 per cent; Canadian, 6 per cent; German, 3 per cent; Russian and Austrian 3 per cent, and a scattering of Finns, Italians, Irish, English and Scotch.

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E. DUDLEY PARSONS,
Author of 'The Story of Minnesota.'

DULWICH (dŭl'ĭch) **GALLERY,** a collection of paintings in Dulwich College, the first 371 of which were presented by Sir Peter Francis Bourgeois, the English painter, with a donation of £12,000 for the maintenance of the collection and the repair of a wing of the college. This original collection contained 22 paintings by Bourgeois. See BOURGEOIS, SIR PETER FRANCIS.

DUMA, a Russian word signifying a council or assembly, from *duma,* thought; *dumat,* to meditate, reflect. A town council or city hall is called górodskaya duma, from górod, town; the national Parliament is termed gosudárstvennaya duma, from gosudárstvo, state, empire. In Western literature Duma means the national Parliament of Russia, the first of which was opened 10 May 1906. On 19 Aug. 1905 the Tsar Nicholas II issued a manifesto announcing that he had granted a constitution to Russia and that an imperial Duma would be created. This was the second attempt made by a Russian sovereign to introduce a semblance of popular government. Already in the 16th and 17th centuries the tsars of Old Muscovy convoked occasional "Zemski Sobors," with almost nugatory powers; and Ivan the Terrible once summoned an assembly to deliberate upon the question as to whether a war with Poland should be continued. All that we know of this gathering is that its 399 members readily voted for the continuation of the war and at the same time begged the tyrant's pardon for having dared to express any opinion at all. Again,

in 1613, when a new dynasty had to be chosen in the place of the extinct Rurik dynasty, the boyars (aristocrats) convoked a kind of States-General which elected the House of Romanoff. After 300 years that house was swept away by the revolution of 1917. But it was the vain-gloriously ambitious Catharine II who first made a show of being imbued with the constitutional and humanitarian maxims of Montesquieu and Beccaria. By a rescript dated 14 Dec. 1766 she announced a great legislative assembly which, though not destined to deal with the form of government, was otherwise left free to discuss the grievances of the people and to suggest remedies. On 30 July 1767 the assembly of 564 members met in Moscow. In December 1768 the majority were called into the army or sent home. A small remnant continued their innocuous sessions till 1774, when Catharine abolished them also. For the next 132 years Russia waited for representative government.

The Duma of 1906 was formally inaugurated by a speech of the Tsar. He promised that he would "unswervingly uphold the institutions he had granted." But the often-disillusioned constitutional democrats who formed the majority received his words with coldness and misgivings. They soon discovered that the wish nearest their hearts — an amnesty for political offenders — would not be realized. The first session was brief and stormy. The deputies, over-endowed with the gifts of oratory and possessing little or no experience of affairs, made magnificent speeches and magnificent demands. The Duma was thwarted at every turn by the government and was finally dissolved after an existence of 10 weeks (22 July). "A cruel disappointment has befallen our expectations," read the Imperial ukase; "the representatives of the nation, instead of applying themselves to the work of productive legislation, have strayed into spheres beyond their competence, and have been making inquiries into the acts of local authorities established by ourselves, and have been making comments on the imperfections of the fundamental laws, which can only be modified by our Imperial will." The "inquiries" referred to concerned the massacres at Bialystok, whither the Duma had sent a commission; its report created a profound and melancholy impression. It was also the drastic agrarian program of the majority of the Duma that helped to bring about the crisis. Indeed, unless the Tsar had consented to abolish the whole of the bureaucracy and appoint a responsible ministry, it is difficult to see how he could have allowed the Duma to continue. The cleavage was too deep between his officials and those whom he called "the representatives of the nation." The second Duma was convened on 5 March 1907, and only lived till 16 June 1907. The third met in November 1907 and sat till 1912. The fourth Duma opened in November 1912. See RUSSIA — GOVERNMENT; HISTORY; REVOLUTION.

HENRI F. KLEIN,
Editorial Staff of The Americana.

DUMANJUG, doo-măn-*hoog*, Philippines, a town of the province of Cébu, situated on the west coast at the mouth of the Dumanjug River, 37 miles southwest of Cébu. Pop. about 20,000.

DUMAS, dü-mä, **Alexandre**, THE ELDER, French dramatist and novelist: b. Villers-Cotterets, 24 July 1803; d. Puits, near Dieppe, 5 Dec. 1870. He was the son of a Republican general who bore the same name, and grandson of Marquis de la Pailletrie and a negress, Tiennette Dumas. He went to Paris at the age of 20 to push his fortune and was employed by the Duke of Orleans as a clerk at 1,200 francs a year. He now devoted his leisure hours to completing his education, and his ambition prompted him to shine in the field of literature. Some of his lighter dramatic works were rejected by the theatrical directors, some were accepted and had more or less success, bringing but little fame or profit to their author. At last, in 1829, his drama of 'Henri III' appeared on the stage of the Comédie Française. It was produced when the battle between the Romanticists and the Classicists was at its height and hailed as a triumph by the former school. The piece became popular and brought the lucky dramatist the sum of 30,000 francs and the post of assistant librarian to the Duke of Orleans. In the following year appeared his 'Christine' and in quick succession 'Antony'; 'Richard d'Arlington'; 'Térésa'; 'Le Tour de Nesle'; 'Catharine Howard'; 'Mlle. de Belle-Isle,' etc. Dumas had now become a noted Parisian character. The critics fought over the merits of his pieces and the scandalmongers over his prodigality and *galanteries*. Turning his attention to romance and desirous of becoming the Walter Scott of his country he produced a series of historical romances, among which are 'Les deux Dianes,' 'La Reine Margot,' 'Les trois mousquetaires' which, with its continuations, occupies eight volumes. The 'Comte de Monte-Cristo' and 'Memoires d'un médicin' are also well known, through translations, to English and American readers. Several historical works also bear his name: 'Louis XIV et son siècle,' 'Le Regent et Louis XV,' 'Le drame de '93,' 'Florence et les Médicis,' etc. In 1840 he married Ida Ferrier, an actress, but the marriage appears to have severed the friendly relations that had long subsisted between them. In 1846 he accompanied the Duke of Montpensier to Spain as the historiographer of his marriage; and on his return to Paris he opened a theatre for the purpose of producing only his own pieces and built a fantastic and costly country-seat, which was known as the Château de Monte-Cristo and on which he expended 450,000 francs.

It is difficult to come to a satisfactory conclusion as to the merits of this author. Some of his productions are little else than mere translations from English and German sources. His first drama, 'Henri III,' is but a skilful piece of patchwork, Walter Scott and Schiller furnishing him with the bulk of the material. Equally fatal to his reputation is our knowledge of the fact, gained from a lawsuit he had with the *Presse* and the *Constitutionnel* newspapers and from a work by Mirecourt entitled 'Fabrique de Romans, Maison A. Dumas et Cie.' (Dumas & Company's Romance Factory), that he had arranged to supply those journals during the year with more novels than the most expert scribe could copy in the time, and that he had in his pay numerous hacks who did the serious part of the work. "His brain worked faster than his hand or any human hand could obey its orders: the mine of his inventive faculty needed a commercial company and an army of diggers for its exploitation";

and he constituted himself "the managing director of the company." The productivity of himself and his hacks extended to 1,200 volumes. Inaccurate in his history and superficial as his character drawing is, of the genius of Dumas there can be no reasonable doubt; he had great fertility of invention, much humor and gaiety and genuine dramatic power, as the works that were undoubtedly from his pen sufficiently testify; and it was not till he had secured a front rank in literature by his own exertions that he descended to the unworthy plan of employing assistants to manufacture novels to order. (See COUNT OF MONTE CRISTO, THE; THREE MUSKETEERS, THE). Consult Blaze de Bury, 'Alexandre Dumas, sa vie, son temps, son œuvre' (1885); Davidson, 'Alexandre Dumas père: his Life and Works, with Bibliography' (New York 1902); Maurel, 'Les Trois Dumas' (Paris 1896); Parigot, 'Le Drame d'Alexandre Dumas' (Paris 1898); and 'Alexandre Dumas père' (Paris 1902); Spure, 'Life and Writings of Alexandre Dumas' (1902); Wells, 'A Century of French Fiction' (London 1898).

DUMAS, Alexandre, THE YOUNGER, French dramatist and novelist: b. Paris, 28 July 1824; d. there, 27 Nov. 1895. He was the natural son of Dumas the Elder (q.v.), and while a young man shared his father's life in Paris and accompanied him on his travels. In 1847 there appeared a collection of his poems under the title 'Péchés de Jeunesse'; his first novel 'Aventures de quatre femmes et d'un perroquet,' was published in the same year; others of his novels are 'Césarine' (1848); 'La Dame aux Camélias' (1848); 'Le Docteur Servans' (1849); and 'L'affaire Clémenceau' (1867). 'La Dame aux Camélias' was dramatized in 1852, and marked an important event in the history of the drama — the introduction of realism in the treating of social and moral problems on the stage. His other dramas include: 'Diane de Lys' (1853); 'Le Demi-monde' (1855); 'La Question d'Argent' (1857); 'Le Fils Naturel' (1858); 'Le Père Prodigue' (1859); 'L'Ami des Femmes' (1864); 'La Femme de Claude' (1873); 'La Princesse de Bagdad' (1881); 'Denise' (1885); and 'Francillon' (1887). He has also written a few essays, discussing social problems; these are: 'Lettre sur les choses du jour' (1871); 'L'Homme-Femme' (1872); 'Question du Divorce' (1880); 'Recherche de la paternité' (1883). Dumas was made a member of the French Academy in 1874. Dumas brought the drama back from the exalted realms of poetry and romance to prose and sober realities and he was the chief creator of the modern "comedy of manners." Beginning as a realist, he ended as moralist and sermonizer and in a series of what would now be called "problem plays." His wit is sparkling and brilliant but acidulated, his dialogue clear and incisive; his view of woman is somewhat ignoble; the husband, the wife and the lover form a trinity of types that are repeated in his works with a disagreeable and persistent iteration. See LADY OF THE CAMELLIAS, LA; DEMI-MONDE, LE.

DUMAS, Jean Baptiste André, French chemist: b. Alais, Gard, 14 July 1800; d. Cannes, France, 11 April 1884. He studied at Geneva and going to Paris in 1821, was first a lecturer in the École Polytechnique, then professor of chemistry in the Athénée, the École Centrale des Arts et Manufactures (founded by himself), and finally, the Sorbonne. He now wholly devoted himself to chemical studies and his views on chemical equivalents and especially his memoir on the atomic theory, soon attracted attention over all Europe. His views on the laws of substitutions involved him in a long discussion with the great Berzelius. His researches in organic chemistry, especially his masterly papers on the ethers, ethereal oils, indigo and the alkaloids, placed him in the first rank of chemists. In 1849–51 he was Minister of Agriculture and Commerce and also held offices under the Second Empire. In 1875 he was called to fill Guizot's chair in the Academy. His chief works are 'Traité de Chimie appliquée aux arts,' and 'Lecons sur la philosophie chimique.' Consult Maindron, 'L'Œuvre de J. B. Dumas' (1886).

DUMAS, Matthieu, French soldier and military writer: b. Montpellier, France, 23 Nov. 1753; d. Paris, 16 Oct. 1837. He early entered the French cavalry, took part in the American Revolution and was employed in the Levant and in Holland. At the commencement of the French Revolution he assisted Lafayette in organizing the National Guard. On the triumph of the extreme party in 1797 Dumas was proscribed, but made his escape to Holstein, where he wrote the first part of his 'Précis des Événements militaires,' a valuable source for the history of the period of which it treats (1798–1807). He served under Napoleon in the Austerlitz and Moscow campaigns and was taken prisoner. On the return of the Emperor from Elba he was employed in organizing the National Guard. After the Restoration, Louis XVIII appointed him Councillor of State. In 1830 he aided in bringing on the revolution of July and after the fall of Charles X was given a peerage.

DU MAURIER, dü mō-rē-a, **George Louis Palmella Busson,** English artist, caricaturist and novelist: b. Paris, 6 March 1834; d. London, 8 Oct. 1896. He belonged to an old French family which had been driven to England by the Revolution. He spent some years in France and Belgium and afterward went to school in London. He soon adopted art as a profession, working as a student in the galleries of the British Museum. Then, returning to Paris, he entered the studio of Gleyre and next went to Antwerp to continue his artistic training, where he lost the sight of an eye. Returning to London, he began to draw on wood for *Once a Week*, the *Cornhill Magazine*, etc., and also exhibited at the Royal Academy. He joined the *Punch* staff in 1864 and became famous through his weekly drawings of the fashionable and artistic world for that publication. He also illustrated a large number of books, including Thackeray's 'Esmond' and 'Ballads.' A collection of his *Punch* woodcuts was published in 1880 under the title 'English Society at Home.' In 1891 appeared his first novel, 'Peter Ibbetson,' and it was succeeded in 1894 by 'Trilby,' which was first published in *Harper's Magazine* and was overwhelmingly successful. The novel was dramatized and successfully produced in America by Paul M. Potter and in London by Sir Herbert Tree. An incomplete novel, 'The Martian,' was published posthumously,

also in *Harper's Magazine*. His novels can hardly be looked upon as very serious contributions to literature, but his *Punch* drawings and «Trilby» will have permanent value as portraying many of the peculiarities of contemporary society. See PETER IBBETSON; TRILBY.

DUMB AGUE, an irregular intermittent fever, so named from the absence of shivering chills. See MALARIA.

DUMB-BELL. See GYMNASTICS.

DUMB-CANE, a popular name for a West Indian plant (Dieffenbachia seguine) of the arum family. The acridity which is characteristic of most of the members of the arum family in this species causes a swelling of the tongue with excruciating pain, if the plant is chewed and for a time destroys the power of speech, whence its name. Some species and varieties of Dieffenbachia are in cultivation as foliage plants.

DUMBA, Dr. Constantine Theodor, Austrian diplomat: b. Vienna, Austria, 17 June 1856. Descended from a prominent and wealthy family, he was educated at the University of Vienna and the École des Sciences Politiques et Morales, Paris. He entered the Austrian Foreign Office in 1879, was created a privy councillor in 1908 and served for some years as Minister to Sweden. In March 1913 he was appointed Austro-Hungarian Ambassador to the United States and assumed the office on 24 April. During the early stages of the European War Dr. Dumba, in conjunction with Count Bernstorff (q.v.), the German Ambassador in Washington, engaged in a widespread conspiracy to foment labor troubles among the employees of the Bethlehem Steel Works and other plants making munitions for the Allies. The plot was revealed through the detention by the British authorities on 30 Aug. 1915 of an American journalist, J. F. J. Archibald, a passenger on the steamship *Rotterdam*, which put in at Falmouth. A number of documents found in Archibald's possession were seized. Among them was a long letter written by Dr. Dumba to Baron Burian, the Austrian Foreign Minister, stating that «we could, if not entirely prevent the production of war material in Bethlehem and in the Middle West, at any rate strongly disorganize it and hold it up for months, which, according to the statement of the German Military Attaché (Captain von Papen), is of great importance,» amply outweighing the «relatively small sacrifice of money.» Archibald was also the bearer of a dispatch from von Papen to the German War Office. The publication of these documents by the British government caused a sensation in the United States and evoked general condemnation of the undiplomatic activities of Dr. Dumba in a country at that time both «neutral and friendly» to the nation which he represented. On 5 Sept. 1915 Dr. Dumba defended his action as being «nothing more than a very open and perfectly proper method to be taken to bring before men of our races (Hungarians, Croats, etc.) . . . the fact that they were engaged in enterprises unfriendly to their fatherland.» Four days later Secretary of State Lansing announced that the American Ambassador in Vienna had been instructed to demand the recall of Dr. Dumba on account of his improper conduct. The Austrian government issued a formal recall on 28 September; the British government granted a safe conduct and Dr. Dumba sailed from New York on 5 Oct. 1915. Von Papen and Captain Boy-Ed, the German attachés in Washington, were dismissed from the United States a few weeks later. It subsequently transpired that Archibald had received $5,000 from the German Embassy in Washington on 24 April 1915. The full story of the Austro-German conspiracies in America is told in *The World's Work*, Feb., March, April, May, et seq. 1918. See WAR, EUROPEAN.

DUMBARTON (ancient LENNOX or LEVENIX). (1) A maritime county of Scotland. Pop. 113,870. (2) A seaport, and the chief town in the county, on the Leven; 13 miles northwest of Glasgow. Ship-building is the chief business, the six principal yards employing about 4,000 men. The rock and castle of Dumbarton, a short distance from the town, are noted in history. The fortress was erected over a thousand years ago. It is one of the four fortresses stipulated to be kept in repair by the articles of the Union. It was the capital of the British district of Strathclyde. Under the Romans, a naval depot was established called Theodosia. It was made a royal burgh by Alexander II in 1221. Sir William Wallace was imprisoned here, and Mary, Queen of Scots spent her childhood at the castle. Pop. about 20,000.

DUMBNESS. See DEAF, THE.

DUMDUM, India, town in the province of Bengal, seven miles northeast of Calcutta. It includes the municipalities of North and South Dumdum (pop. 10,000 and 11,000 respectively), North Dumdum including the cantonment. The town is famous as being the scene of the first open manifestation of the Sepoys against the greased cartridges which led to the outbreak of the mutiny of 1857, and is the site of the ammunition factory of the Indian ordnance department.

DUMDUM BULLET, a bullet so named after Dumdum Arsenal, the place near Calcutta where it was first made. The British found in their frontier wars with the Afghans and the hill tribes, that the ordinary bullet, Lee-Metford, in spite of its immense penetrative power, had not sufficient stopping power, persons hit being known to fight on. The dumdum is a soft-nosed or expanding bullet — one which instead of having its greatest strength at the point is weakest there, so that in striking a bone it will flatten out and shatter it and not, like the modern steel-coated, sharp-pointed bullet, make a small hole and pass through without any other effect. At Santiago the Spaniards were charged with cutting off the brass tips of their bullets so that they had the same effect in inflicting jagged wounds as the regular dumdum bullets. Dumdum bullets are now used to some extent by big game hunters. Their use was prohibited in warfare by The Hague Conference. In the war against the Boers in South Africa (1899–1902) the British were charged with using a modification of this bullet. In the Great European War the French — who use a solid copper-zinc alloy with no jacket and no lead and therefore incapable of expanding —

have been accused of using soft-nosed bullets. See BULLET.

DUMÉRIL, dü-mā-rēl, **André Marie Constant,** French physician and naturalist: b. Amiens, 1 Jan. 1774; d. Paris, 2 Aug. 1860. From 1801 to 1818 he was professor of anatomy and of physiology of the medical faculty of Paris. His works on natural history and analytical zoology are distinguished both for accuracy of details and for philosophical treatment. In his most celebrated production, 'L'erpétologie générale (1835–51), which contains the first attempt at a systematic description of all known reptiles, he had Bibron as collaborator.

DUMERSAN, dü-mār-sāṅ', **Théophile Marion,** French playwright: b. Issoudun, 4 Jan. 1780; d. Paris, 13 April 1849. He was employed in the Paris mint. He wrote many plays, all marked by keen observation and comic spirit. His 'Angel and Devil,' a five-act drama, had a "run" of over 100 presentations; still more successful was his 'Mountebanks,' his masterpiece and a classic in its kind. Other very successful plays written by him are 'The Wigmaker, or Heads à la Titus'; 'Ridiculous Englishwomen.' Worthy of mention is his volume of 'National and Popular Songs of France.'

DUMFRIES, dŭm-frēz', or **DUMFRIESSHIRE,** a maritime county, Scotland, bounded on the southeast by Cumberland and Solway Firth. Long ranges of mountains enclose it on the north. The country is divided into Nithdale, Annandale and Eskdale, named according to the three principal rivers, the Nith, the Annan and the Esk. There are a number of small locks; area 1,103 square miles. The surface is irregular; about one-half is good farming and grazing land, and valuable minerals are found in the hill sections. There are also important salmon fisheries. The county is represented by a member in the House of Commons. Pop. about 75,000.

DUMFRIES, Scotland, a river port, railroad centre and parliamentary borough, capital of the county of same name, on the Nith, six miles from its junction with the Solway Firth. It is connected with the suburb Maxwelltown (in Kirkcudbright) by three bridges, one dating from the 13th century. It is built of red sandstone and contains several fine public buildings. The town is especially associated with memories of Robert Burns. The house in which he lived is still preserved. His mausoleum stands in Saint Michael's churchyard. In the neighborhood are the ruins of Caerlaverock Castle, famous in connection with the Maxwells and Lincluden Abbey. Dumfries became a royal burgh in the 12th century. The Border Wars wrought much havoc to the town. The Young Pretender made this place his headquarters in 1745.

The principal manufactures are tweeds and hosiery. There is a brisk local trade in farm products. The modern buildings include the County House, the post-office, Crichton Royal Institution (a lunatic asylum), Dumfries Academy. In High street there is a fine tower erected by Inigo Jones. Pop. about 19,000.

DUMMER, Jeremiah, American scholar: b. Boston, about 1680; d. in Plaistow, England, 19 May 1739. He was graduated at Harvard College in 1699, where he was noted for the vigor and brilliancy of his genius. With the purpose of preparing for the clerical profession, he went abroad, and studied in the University of Utrecht. On his return to America he abandoned his chosen vocation, and soon after went to England, where, as agent of Massachusetts, he rendered important services to his countrymen. He was an admirer of Lord Bolingbroke, in whose daring and reckless genius he found much that was congenial to his own character, and in intimacy with whom he adopted something of his moral and religious license. He published theological and philosophical disquisitions in Latin while at Utrecht, and his 'Defence of the New England Charters,' written in England (1728), is admirable both in style and matter. The traditions and records concerning him alike testify to his remarkable powers, and his easy command of them in speaking, writing and in intercourse with men.

DUMMER'S WAR, 1724–25, an episode in the long struggle of the French governors of Canada to check English settlement by inciting the Indians to raids and massacre of the border settlers. It was named after William Dummer, acting-governor of Massachusetts, who organized the resistance against the Indian expeditions sent by Vaudreuil, governor of Canada, against the villages of Massachusetts and Maine, and of Vermont where Fort Dummer had been built on the site of Brattleboro in 1724. One of its chief incidents was the aggressive retaliation of Dummer and the victorious assault by the English on Norridgewock, Me., when Sebastien Rale, the Jesuit missionary and Indian leader, was killed with 26 Abenaki Indians, 12 August 1724. The further crushing decimation in Lovewell's fight (q.v.) at Fryeburg, Me., 8 May 1725, led to four Indian chiefs signing a treaty for the Penobscots and other Abenakis at Boston in November 1725, which was ratified by the latter the following year. Consult Parkman, 'A Century of Conflict' (Boston 1892).

DU MOND, Frank Vincent, American artist: b. Rochester, N. Y., 1865. He was a pupil of Boulanger, Lefebvre and Benjamin Constant. His works include a wide range of subjects, from popular magazine paintings to religious and ideal. Among them are 'October,' 'The Baptism,' 'Portia' and 'Grassy Hill.' He was elected to membership in the National Academy of Design in 1906, and became a prominent teacher at the Art Students' League.

DUMONT, dü-môṅ, **Albert,** French archæologist: b. Scey-sur-Saône, 1842; d. 1884. He was educated in Paris, and devoting himself to the study of prehistoric, Byzantine, and Christian archæology, published "De Plumbeis apud Græcos Tesseris' (1870); 'Inscriptions céramiques de Grèce' (1871); and 'Vases peints de la Grèce propre' (1873). In 1874, in Rome, and the following year in Athens, he lectured on archæology and the history of art. In 1878 he was elected rector of the academy of Grenoble, in 1879 rector of the academy of Montpellier, and until his early death was a superintendent of higher education. The most important of his later works is 'Les céramiques de la Grèce

propre, vases peints et terres cuites' (1882–90), prepared in collaboration with Chaplain.

DUMONT, dü-môn, **Augustine Alexandre,** French sculptor: b. Paris, 14 Aug. 1801; d. there, 25 Jan. 1884. He was a most prolific worker, and his statues are found on or in many of the public buildings and churches of his native city. His most noted productions are, the colossal statues of the 'Genius of Liberty' on the Column of July, made in 1840, and the statue of Napoleon III on the Column Vendome.

DUMONT, Gabriel: b. Manitoba, 1838; d. Batoche, 1906. He acted as Riel's adjutant-general in the North West Rebellion of 1885, and was the organizing brain of the movement, showing great military skill in his conduct of the campaign. After the rising had been crushed at Batoche, he fled to the United States, but returned at a later date to Saskatchewan.

DUMONT, Pierre Etienne Louis, Swiss scholar: b. Geneva, 18 July 1759; d. Milan, Italy, 30 Sept. 1829. In 1785 he became tutor in London to the sons of Lord Shelburne. His superior talents soon recommended him to the illustrious Whigs of that period; with Romilly, in particular, he formed a close friendship. During the early years of the French Revolution, Dumont was at Paris, where he became greatly attached to Mirabeau, regarding whom he has given the world much valuable information in his posthumous 'Souvenirs sur Mirabeau' (1832). In this work he claims to have composed for him many of Mirabeau's most eloquent speeches. In 1791 Dumont returned to England, and formed an intimacy with Bentham (q.v.), of whom he became an ardent disciple and the greatest expositor of his philosophy. Deeply convinced of the value of Bentham"s views on legislation, he requested him to allow him to arrange and edit his unpublished writings on this subject. Bentham gave him his manuscripts, which Dumont labored earnestly to abridge, elucidate, correct, and simplify. The results appeared in his 'Traité de legislation civile et penale' (1802); 'Théorie des peines et des récompenses' (1811); 'Tactique des Assemblés Législatives' (1816); 'Preuves judiciaires' (1823); and the 'Organisation judiciaire et codification' (1828). Dumont returned to Geneva in 1814, and became a member of the representative council.

DUMONT D'URVILLE, Jules Sébastien César, French navigator: b. Condé-sur-Noireau, Normandy, 23 May 1790; d. near Paris, 8 May 1842. He entered the navy, in which he ultimately rose to be vice-admiral. He was twice wrecked and on both occasions owed his escape chiefly to self-possession and skilful seamanship. He rendered important service by his three years' search for the remains of the ill-fated expedition of La Pérouse, the survey of long tracts of coast in New Zealand and New Guinea, the discovery of numerous islands and of an antarctic continent, and the exploration of very dangerous and still imperfectly known tracts of navigation, as Torres Straits, in Australia, and Cook's Straits, between the two large islands of New Zealand. To his contributions to geography he was indebted for his nomination to the office of president of the Paris Geographical Society. One fruit of his voyages was the 'Enumeratio plantarum quas in insulis Archipelagi aut Littoribus Ponti Euxini' (1822). After his second circumnavigation, he published the 'Voyage de l'Astrolabe' (1830–35), and 'Voyage pittoresque autour du monde' (1834). He was killed in a railway accident.

DUMORTIERITE, a native basic silicate of aluminum, of somewhat uncertain composition. In some specimens, notably those from Arizona, from 2½ to 5 per cent of the alumina has been displaced by boron. The average constitution is silica 30.5 per cent, alumina 69.5 per cent. It crystallizes in fibrous or columnar forms belonging to the orthorhombic system, and has a hardness of 7 and a specific gravity of about 3.3. It is transparent or translucent, with a vitreous lustre and a blue or greenish blue color, and is strongly pleochroic. Dumortierite occurs near Lyons, France, and also in certain parts of Norway and Silesia. In the United States it is found in upper Manhattan, New York City, and in Yuma County, Arizona. The mineral is named for Eugene Dumortier, a French palæontologist.

DUMOULIN, dü-moo-lăn, **John Philip,** Canadian Anglican bishop: b. Dublin, Ireland, 1836; d. 28 Mar. 1911. He was educated at Trinity College, Dublin, and emigrating to Canada was ordained priest in 1863. He was appointed rector and canon of St. James's Cathedral, Toronto, in 1882, and in 1896 was elected third bishop of Niagara.

DUMOURIEZ, dü-moo-rē-ā, **Charles François,** French general: b. Cambrai, 25 Jan. 1739; d. near Henley-upon-Thames, 14 March 1823. He entered the army early in life and at 24 years of age had received 22 wounds, and was made a knight of Saint Louis. In 1772 Louis XV sent him with communications to Sweden, but he was arrested, and for a long time confined in the Bastile. In 1789 we find him a principal director of the Jacobin club, composed of all who aspired to be accounted the friends of liberty. He afterward became a minister of Louis XVI, when he strongly advised the monarch to yield the direction of the interior affairs of the kingdom to the council of the assembly then sitting, and to declare war against the foreign foes of France. The advice was disregarded and Dumouriez was dismissed. Still determined to devote himself to the service of the army, he proceeded to Valenciennes, where he soon gained fame by his valor and his firmness, displayed at the head of the French soldiers, having succeeded Lafayette in the command of the Army of the North. He rendered very important service to his country by the stand he so skilfully made against the Prussian invaders in the forest of Argonne, in September 1792, the famous "Cannonadé of Valmy" taking place on the 20th of the same month. His rapid conquest of Belgium followed; but he was defeated at Nierwinden in January 1793. Notwithstanding his successes, the Directory, not without cause, entertained suspicions regarding his designs. Dumouriez, who had no sympathy with the Revolutionary government, had entered into secret negotiations with the enemy, and learning that an accusation of treason was to be brought against him, he fled to the Austrian headquarters. He refused, nevertheless, to serve against his country; wandering for some time through Europe and lastly settled in England. Consult

his 'Memoirs' (Hamburg, 1794) and the enlarged edition published at Paris; the 'Life' by Monchanin (1884); Griffiths, 'French Revolutionary Generals' (London 1891); Rose and Broadley, 'The Defence of England against Napoleon' (London 1908).

DUN Celtic *dun*, Irish *dūn*, Gael *dūn*, a hill, castle), a word used as a prefix or suffix in the names of cities as, in Augustodunum (Autun), and in many names in Scotland and Ireland, as in Dunblane, Dundee, Dundalk, Dunboyne, etc.

DUNA, or SOUTHERN DVINA, so named to distinguish it from the northern Dvina, a west Russian river, which flows from a small lake near the source of the Volga, in the southwest of the government of Tver, and after a circuitous route of about 650 miles with a generally northwestern trend, empties into the Gulf of Riga, 10 miles below Riga. For some distance it forms the boundary between the governments of Vitebsk and Livonia on the north bank and Vilna and Courland on the south bank. Although obstructed by rocks and rapids, it is navigable for ocean vessels to Riga, for vessels of lighter draft to Dünaburg and for flat-bottomed barges almost from its source; it commands a large river traffic; on an average it is icebound 115 days in the year. Canals connect it with the Volga, the Beresina, the Niemen and Lake Ilmen.

DUNABURG, dünä-boorg. See DVINSK.

DUNANT, dü-näñ, **Jean Henri,** Swiss philanthropist and founder of the Red Cross Society: b. Geneva, May 1828; d. 30 Oct. 1910. He early advocated the cause of suffering humanity and wrote a work on the slave systems of Mohammedan countries and the United States. While traveling near the battlefield of Solferino in 1859 he took part in the relief of those wounded in that battle and realized the inadequacy of the provisions for the work. As the result of his experiences there he wrote 'Un souvenir de Solferino,' advocating more efficient care of the wounded on the field of battle. This work and his agitation directed public attention to the subject and ultimately brought about the Geneva Conference in 1863, followed by the Geneva Convention of the Great Powers in 1864 and the founding of the Red Cross Society (q.v.). Jointly with Frederick Passy in 1901 he received the Nobel prize.

DUNBAR, Paul Laurence, American author: b. Dayton, Ohio, 27 June 1872; d. 10 Feb. 1906. He was of African descent, was educated in the public schools of Dayton and was graduated from the Dayton High School in 1891, and from that time devoted himself to literature and journalism. After 1898 he was on the staff of the librarian of Congress. He appeared in public as a reader of his poems. He published 'Oak and Ivy' (poems) (1893); 'Majors and Minors' (1895); 'Lyrics of Lowly Life' (1896) 'Folks from Dixie' (1898); 'The Uncalled,' a novel (1898); 'Lyrics of the Hearthside' (1899); poems of 'Cabin and Field' (1899); 'The Strength of Gideon' (1900); The Love of Landry' (1900); 'The Sport of the Gods,' a novel (1901); 'The Fanatics,' a novel (1901); 'Lyrics of Love and Laughter' (1903); 'Li'l Gal' (1904); Lyrics of Sunshine and Shadow' (1905). Consult 'Complete Poetical Works,' with Introduction to 'Lyrics of Lowly Life,' by W. D. Howells (New York 1913), and Wiggins, L. K., 'Life and Works of Paul Laurence Dunbar' (1907).

DUNBAR, William, Scottish poet: b. Salton, East Lothian, about 1465; d. about 1525. He was a Franciscan friar, but was often employed by James IV in affairs of state. Among his works are the panegyric poem 'The Thistle and the Rose,' written (1503) on the marriage of James with Margaret of England, and 'The Golden Targe' (1508), consisting of allegories in the fashion of the time and of Chaucer, among them a poem on 'The Dance of the Seven Deadly Sins Through Hell.' He is at his best in burlesque poetry, as witness the autobiographical 'Visitation of St. Francis.' He is as "rich in fancy as Spenser; as homely and shrewd as Chaucer in the 'Miller's Tale'; as pious as Cowper in his hymns, and as wittily grotesque as Burns in 'Death and Dr. Hornbook.'" His works, edited by Laing, were published in London (2 vols.) 1834, and by Small and Mackay for the Scottish Text Society (Edinburgh 1884–93).

DUNBAR, Scotland, royal and municipal borough and seaport in Haddingtonshire, at the mouth of the Firth of Forth, 29 miles east of Edinburgh by rail. It is a place of great antiquity, having originated in a castle, once of great strength and importance, which underwent several memorable sieges; on one occasion being successfully defended against the English for 19 weeks by Black Agnes, Countess of Dunbar (1338). Queen Mary and Bothwell (1567) took shelter in this castle. In 1650 Cromwell, at the "Race of Dunbar," totally defeated the Scottish army under David Leslie. The harbor, opened in 1844, is not very commodious, but the town is an important fishing station. Pop. 3,346.

DUNBIRD, a British sportsman's name for the female of the Pochard duck.

DUNCAN, Isadora, American dancer: b. San Francisco 1880. She was a teacher of dancing in New York and made an earnest attempt to revive the simple ancient Greek dances. Her efforts meeting with little success she went abroad and soon became very popular in Munich, Berlin and Paris. She established a dancing school at Grünewald, near Berlin, for girls from 4 to 14 years of age, who receive free board and schooling. Miss Duncan popularized the barefoot dance in simple draperies. In 1913 her two children were carried by a runaway motor over the Seine embankment and drowned, after which she went into temporary retirement.

DUNCAN, James, American labor leader: b. Kincardine County, Scotland, 5 May 1857. He was educated at Aberdeen, Scotland, and removed to the United States. From 1873 he was a granite cutter, also granite statue cutter. He was secretary of the New York branch in 1881, of the Baltimore branch in 1884 and international president in 1895 of the Granite Cutters' International Association. He organized and led a successful educational campaign in the union and ultimately the great strike in the granite-cutting industry for an eight-hour workday in 1900. After 1895 he was editor of the *Granite Cutters' Journal;* was vice-president

of the American Federation of Labor in 1894; represented the American labor movement to the British Trades Congress at Bristol, England, in 1898. He also represented the American Federation of Labor at the International Secretariat Conference of Labor, Budapest, Hungary, in 1911. He is a member of the American Academy of Political and Social Science.

DUNCAN, John, Scottish theologian and Hebraist: b. Aberdeen, 1796; d. 1870. He received his education at Marischal College, was ordained in 1836, preached for some time in Milton Church, Glasgow, and in 1840 was sent to Pesth as a missionary to convert the Jews. His most celebrated converts were Dr. Edersheim and the Rev. Adolph Saphir. Returning from Pesth in 1843, Duncan was appointed to the chair of Oriental languages in New College, Edinburgh, a position which he held until his death. Consult Brown, David, 'Life of John Duncan' (Aberdeen 1872); Knight, 'Colloquia peripatetica' (1870; 5th ed., 1879) and Stuart, 'Recollections of Duncan.'

DUNCAN, Louis, American electrical engineer: b. Washington, D. C., 25 March 1862; d. Pelham Manor, N. Y., 13 Feb. 1916. He was graduated from the United States Naval Academy in 1880, and served in the navy until 1887. During this time he pursued advanced studies at Johns Hopkins University, becoming a Ph.D. in 1885. He was major of the first volunteer engineers during the war with Spain. Later he began his connection with Johns Hopkins, being associate in, and subsequently associate professor of applied electricity (1887–98). From 1902–04 he was head professor of electrical engineering at the Massachusetts Institute of Technology. He was elected president of the American Institute of Electrical Engineers in 1895. He wrote many articles on engineering topics in scientific journals and was a member of several scientific bodies. He specialized in electrical traction and as consulting engineer for the rapid transit commission of New York supervised the work of electrifying New York's first subway system. Under his direction, from 1897 to 1901, the Third Avenue Street Railway system of New York was electrified. He also was prominently identified with the underground trolley system in Washington.

DUNCAN, Norman, American journalist: b. Brantford, Ontario, Canada, 2 July 1871; d. Fredonia, N. Y., 18 Oct. 1916. He was educated at the University of Toronto 1891–95, entered journalism and from 1897 to 1901 was on the staff of the New York *Evening Post.* In 1908–10 he was adjunct professor of English literature in the University of Kansas. In 1907–08 he was correspondent for *Harper's Magazine* in Asia Minor and Egypt, and in 1912–13 in the East Indies, Australia, New Guinea, etc. He has written short stories and sketches for the *Atlantic Monthly, McClure's Magazine* and others, and has published 'The Soul of the Street: Stories of the New York Syrian Quarter' (1900); 'The Way of the Sea' (1903); 'Doctor Luke of Labrador' (1904); 'The Mother' (1905); 'The Adventures of Billy Topsail' (1906); 'The Cruise of the Shining Light' (1907); 'Every Man for Himself' (1908); 'Going Down from Jerusalem' (1909); 'The Suitable Child' (1909); 'Higgins' (1909); 'Billy Topsail and Company' (1910); 'The Measure of a Man' (1911); 'The Best of a Bad Job' (1912); 'A God in Israel' (1913); 'The Bird-Store Man' (1914); 'Australian Byways' (1915).

DUNCAN, Robert Kennedy, American chemist: b. Brantford, Canada, 1868; d. 1914. He was graduated at the University of Toronto in 1892 and studied also at Clark and Columbia universities. For several years he taught chemistry and physics in secondary schools and in 1901–06 was professor of chemistry at Washington and Jefferson College. In 1906 he became professor of industrial chemistry at the University of Kansas and four years later was appointed director of industrial research and assumed similar duties at the University of Pittsburgh. In 1911 he was visiting lecturer at Clark University. He was editor of the 'New Science Series' and published 'The New Knowledge' (1905); 'The Chemistry of Commerce' (1907); 'Some Chemical Problems of Today' (1911).

DUNCAN, Sara Jeanette. See COTES, SARA JEANETTE.

DUNCAN, Thomas, Scottish painter: b. Kinclaven, Perthshire, 24 May 1807; d. Edinburgh, 25 May 1845. He began to exhibit at the Scottish Academy in 1828, and became an academician in 1830. He became master of the Trustees' Academy, Edinburgh, in 1840 and an associate of the Royal Academy in 1843. The first picture which extended his fame beyond the Tweed, and helped to procure his admission as an associate of the Royal Academy (1843), was 'Prince Charles Edward and the Highlanders entering Edinburgh after the Battle of Prestonpans' (1840). Another famous picture of his is 'Charles Edward asleep after Culloden, protected by Flora Macdonald.' His last exhibited work was the 'Martyrdom of John Brown of Priesthill,' now in the Corporation Gallery of Glasgow. He also executed many portraits.

DUNCAN, William Wallace, American clergyman: b. Ashland, Va., 20 Dec. 1839; d. 1908. He was graduated at Randolph-Macon College in 1858, joined the Virginia conference the next year and held several important charges. During the Civil War he was a chaplain in the Confederate army. In 1875 he was transferred to the South Carolina conference, and elected professor of mental and moral philosophy in Wofford College. He was a member of the general conferences of 1878, 1882 and 1886, and a delegate to the Œcumenical Council of 1881 in London. In 1886 he was elected bishop of the Methodist Episcopal Church South.

DUNCANSBY HEAD, a picturesque promontory, forming the northeastern extremity of Scotland, in the county of Caithness. It consists of a circular rocky eminence of about two miles in circumference, and is intersected by large ravines and remarkable fissures. About a mile and a half west stood the celebrated John O'Groat's house, of which no trace now remains.

DUNCE, a word introduced by the Thomists or disciples of Thomas Aquinas, in ridicule of the Scotists, or disciples of John Duns Scotus, schoolman, who died 1305 A.D., to denote

a subtle sophist given to caviling where he cannot refute. When the reaction against the schoolmen took place at the Reformation the merits of those acute metaphysicians were temporarily decried, and the celebrated John Duns Scotus came in for a more than ordinary share of disparagement, and he, though a man of very subtle intellect, was held by the more ignorant or prejudiced of the reforming party to be a man of invincible stupidity. He was, therefore, made to stand as the prototype of all modern dunces. Succeeding generations have the unfavorable verdict thus passed on the cultivators of scholastic philosophy.

DUNCIAD, The. This literary Satire, by Pope, is in the form of a mock-epic of 1,700 lines in heroic couplets, and was published in 1729. It is the monumental example of its kind in English. Though professedly a chastisement of the "dunces," the "Grub Street fry," with whom Pope quarreled almost all his life, it really attacks all the writers who intentionally or otherwise, with or without cause, had wounded the poet's vanity. Pope always remembered every line written, every word uttered against himself, and repaid it with interest. Hence, though the professed purpose of his "epic of the dunces" is "to crush these common enemies of mankind," his personal animosity is evident in every line. His protagonist, king of the dunces and the realm of Dullness, was at first Theobald, who had attacked Pope's bad edition of Shakespeare, and had produced a better one, but he was afterward dethroned in favor of Colley Cibber, who in the meantime had ridiculed Pope's unsuccessful play. The Dunciad borrows its general scheme from 'MacFlecknoe' (q.v.), but enlarges the action, notably by the beastly games that celebrate the coronation. Even with this, the action is slight and unimportant. With the third book, foretelling the reign of Dullness, the poem properly ends. In 1742 Pope added a fourth book, made up of fragments composed for another purpose, which realizes the reign of Dullness, and in which Bentley, the Greek scholar, is most unjustifiably made the protagonist.

The Dunciad is dedicated to Swift, whom Pope addresses as a successor to Rabelais. Swift's influence, though certainly not Rabelaisian, is apparent throughout the poem; but whether or not Swift ever really "laughed and shook in Rabelais' easy chair," Pope certainly fails in his own attempt to use the jovial method of the great French satirist. He ends by mangling his enemies, covering them with showers of vile abuse, and then rolling them in mud of peculiar filth and malodor. Though most of his victims were, even as he asserted, of small importance, he has "preserved his flies in amber." Copious explanatory notes, which were needed even with the first edition, now alone render much of the satire intelligible to the modern reader. Yet it is uncritical to regard 'The Dunciad' as little more than a monument of malice. Only one English poet could have written it. Its verse is polished; its expression is concise and incisive to the last degree; its wit is often brilliant; some of its lines, such as "The right divine of kings to govern wrong," have passed into the common stock. The concluding passage of the poem, depicting the universal empire of Dullness, attains the very sublime in mockery and is as sure of immortality as almost any other in English poetry. Among the innumerable imitations of 'The Dunciad,' Byron's 'English Bards and Scotch Reviewers' is by far the ablest and most celebrated. Consult Warton, 'Essay on the Genius and Writings of Pope' (Vol. II, pp. 439–454); Paston, George, 'Mr. Pope' (Vol. I, pp. 351–364); for notes, illustrations, list of imitations, etc., consult Warton's edition of Pope's 'Works' (Vol. V, 1797); Aldine edition; Thorns, W. J., 'Notes on Editions of the Dunciad' (n.d.).

MARION TUCKER.

DUNCKER, doonk'ĕr, **Dora**, German story-writer and humorist: b. 28 March 1855. The conceits 'Incurable' (1893); 'The Sphinx,' and other tales and comedies, have succeeded; while in 'Modern Masters' (1883) she has evolved excellent character studies.

DUNCKER, Maximilian Wolfgang, German historian: b. Berlin, 15 Oct. 1811; d. Anspach, 21 July 1886. Politics interested him in early years, but his later energies were given to elaborate historical investigations, of which the best fruits are 'The Crisis of the Reformation' (1845); 'Feudalism and Aristocracy' (1858); and the masterpiece 'Ancient History' (1852–57).

DUNCOMBE, Thomas Slingsby, English politician: b. 1796; d. 13 Nov. 1861. He was elected member of Parliament for Hertford in 1826–32, and for Finsburg after 1834, assisted in carrying the Reform Bill, was prominent among the advanced Liberals, and, after visiting Canada, warmly defended Lord Durham's administration of that colony. In 1842 he presented the Chartist petition, signed by 3,000,000 of the lower classes, in favor of universal suffrage, vote by ballot, short Parliaments, etc. In 1844 the then Home Secretary having sanctioned the opening of the letters of Mazzini, Duncombe, in the House of Commons, denounced, with scathing invective, the adoption of the post-office spy system on English soil. Consult his 'Life and Correspondence' (London 1868).

DUNDALK, dŭn-dâk', Ireland, maritime town, capital of the county of Louth, on Castletown River, 54 miles north of Dublin. It is an ancient place, has a splendid Roman Catholic cathedral, and in the battle of Faughart (1318) fought in its vicinity, Edward Bruce, the brother of King Robert Bruce of Scotland, was slain. Its manufactures are soap and leather, has shipbuilding and iron founding, and the trade, chiefly in cattle and agricultural produce, is extensive. Pop. 13,128.

DUNDAS, Henry, VISCOUNT MELVILLE, Scottish statesman: b. Edinburgh, 28 April 1742; d. 28 May 1811. He studied at the University of Edinburgh and in 1766 was appointed solicitor-general for Scotland, M. P. for Middlesex in 1774 and lord advocate in 1775. In 1782 he was appointed treasurer of the navy and made a member of the privy council; but he continued only a short time in office. His resolution condemning the conduct of Warren Hastings in India led to the impeachment in 1786. In 1791 he was made Home Secretary, and in 1794 became Secretary of War. In 1802 he was created Viscount Melville. In 1804 he was appointed First Lord of the Admiralty

under Pitt. Next year he was impeached, before the House of Lords, "of high crimes and misdemeanors" in his former office of treasurer of the navy. As the evidence adduced against him did not directly implicate him in the malversation proved against his deputy, he was acquitted. He was long practically the manager of Scottish affairs in which he showed himself a reactionary, and gained notoriety by his rigorous prosecutions of the Scottish radicals in 1795.

DUNDAS, Sir James Whitley Deans, English admiral: b. 1785; d. 1862. In 1799 he entered the navy and reached the rank of commander in 1806. He was flag captain to Sir Thomas Parker and afterward to Sir Philip Dunham. He was made rear-admiral in 1841, was commander in the Mediterranean in 1852 and in the same year became vice-admiral. During the Crimean War he was chief naval commander and had charge of transporting the army to the theatre of war. He was severely criticized for his operations against Sebastopol and was superseded by Sir Edward Lyon in 1855. In 1857 Dundas was made admiral.

DUNDAS, Robert, Lord Arniston, Scottish judge: b. 9 Dec. 1685; d. 1753. He was admitted to the Scottish bar in 1709, and soon became known as a successful lawyer with forcible and ingenious methods of pleading. In 1717 he received the appointment of solicitor-general, which was followed by advancing positions until in 1737 he became a judge, and in 1747 rose to the dignity, which he retained until his death, of lord president of the Court of Session of Scotland. His eldest son, Robert: b. 18 July 1713; d. Edinburgh, 13 Dec. 1787; was educated at Edinburgh University, studied law at Utrecht and Paris; in 1738 was admitted to the Scottish bar, and, like his father, rose through successive Crown positions to that of lord president of the Court of Session of Scotland, which he attained in 1760 and occupied until his death. Owing to his having given his casting vote as lord president against the claimant, Archibald Stewart, in the famous Douglas Cause, in 1767, he was intensely unpopular in Edinburgh.

DUNDAS, Canada, a town in Wentworth County, in the province of Ontario, situated on a bay at the western extremity of Lake Ontario. It is a manufacturing and shipping centre. Pop. 4,299.

DUNDAS ISLAND, British Columbia, an island 40 miles northeast of Queen Charlotte's Islands, separated from Cape Fox, the southernmost point of the Alaskan panhandle, by Chatham Sound.

DUNDAS, or JUBA, ISLANDS, British East Africa, a group of about 500 coral islets off the east coast of Africa in lat. 1° S. The group has one safe anchorage near the mouth of the Durnford River.

DUNDAS STRAIT, Australia, a passage about 18 miles wide, separating Melville Island from Coburg Peninsula in northern Australia.

DUNDEE, Viscount of. See Graham, John.

DUNDEE, Scotland, parliamentary and county burgh and city in County Forfar, on the estuary of the Tay, 8 miles from the sea, and 59½ miles northeast of Edinburgh by rail. It is the third city of Scotland and rises steeply from the water. Its linen trade is the largest in Scotland, and its jute manufactures are the largest in Great Britain. Shipbuilding is an important industry, and it is celebrated for its marmalade and confectionery. It is the centre of the seal and whale fisheries; there are large wet docks and graving docks; and an extensive shipping trade. The number of vessels entering the port in 1916 was 1,906, with a registered tonnage of 540,826. The revenue from tonnage dues amounted to $99,597. The esplanade is nearly three miles in length. There is a fine old parish church, so large that three separate congregations worship under its roof. It has excellent educational facilities and University College is affiliated with the University of Saint Andrews. The public utilities are municipally owned. There are some fine public parks, notably Baxter Park in the east end, presented by Sir David Baxter, and Balgay Hill in the west end. The Tay Bridge (railway) at the west end of the town, giving trunk rail connection with the south, was opened in 1887 to replace an older structure blown down in a hurricane, in 1879, and is two miles in length. Dundee was erected into a royal burgh by William the Lion about 1200; took a prominent part in the War of Independence; was captured by John of Gaunt in 1385; Robert Wishart, the first of the martyred Reformers, preached from its gateway (still standing); it was sacked by Montrose in 1645, and later by General Monk, who put nearly 1,000 of its inhabitants to the sword; and from the burgh Viscount Dundee took his title, his estate of Claverhouse being north of the city, now on its outskirts. The city returns two members to Parliament. The boundaries were enlarged in 1913 to include the outlying suburb of Broughty Ferry. Pop. 176,062.

DUNDONALD, Thomas Cochrane, 10th Earl of. See Cochrane, Thomas.

DUNDONALD INCIDENT. Douglas Ballie Hamilton-Cochrane, 12th Earl of Dundonald, a distinguished army officer, was appointed in 1902 major-general commanding the militia in Canada. For a considerable time there was harmony between Sir Frederick Borden, the Minister of Militia, and the major-general; but in June 1904, at a private banquet given by the local officers at Montreal to Lord Dundonald, he made a speech complaining of the interpolation of political considerations into militia problems, and in particular of the striking out of the name of one of his nominees for a commission. The speech found its way into the press, and Lord Dundonald was dismissed on the ground that he had attacked the government under which he served. Lord Dundonald thereafter conducted a vigorous campaign in his own defense, and the question was one of the minor issues in the Dominion elections of 1904.

DUNDREARY, Lord, a prominent character in Tom Taylor's well-known comedy of 'Our American Cousin.' The part originally contained but 47 lines, but it was enlarged by the actor, E. A. Sothern, who became famous in this rôle.

DUNE, dün, a low sand-hill; an accumulation of sand; a hill-fort, or a regular building

commonly called a Danish fort. Sand dunes are made by the blowing of sand, this material having been produced by the grinding down of rocks under the influence of breakers on the seashore or coast, or any similar agency. Such sand dunes in many places skirt the shores of Holland, Great Britain, Spain and other countries, in some places encroaching on and covering what once was cultivated land. In Michigan, dunes have encroached on forests, completely burying and killing the trees, and have then passed on, again uncovering the forest. In England and Germany, buildings have even been buried and unearthed. Originally the "downs" of England were similar to the dunes. The dunes along the Atlantic coast of the United States have changed materially the form of the coast line; some of these dunes are high hills, and still higher hills are on the coast of some of the islands of the Bahamas. See GEOLOGY and EOLIAN DEPOSITS.

DUNE PLANTS, plants characteristic of dunes, those somewhat unstable sandy areas formed under the influence of wind. The species capable of withstanding these conditions are few in number and are marked by well-developed underground parts, including extensive root and numerous root-hairs, and storage organs, especially rhizomes. They are capable also of being partially buried, without apparent injury. Since some dunes are migratory, or tend to extend over wider and wider areas, thus destroying the natural vegetation, crops and even orchards and forests, these plants are of special interest. Some of them, especially marram or beach grass, also known as sand reed (*Ammophila arenaria*), are widely planted upon beaches and dunes, to hold the sand and prevent its being blown by the wind. The United States Department of Agriculture, through its division of agrostology, has done immense service to landowners along the shores of both the Great Lakes and the ocean coasts, in the planting of soil-binding grasses, as the plants are called. In time the planted areas support other vegetation and the dune may be considered conquered. In general the vegetation characteristic of dunes consists of xerophytes (q.v.), but the xerophytic character is due to the shifting of the sand and not to the conditions of growth. See PLANT GEOGRAPHY.

DUNEDIN, dŭn-ē'dĭn or dŭn-ĕd'ĭn, New Zealand, town, capital of the province of Otago, on Otago harbor. It is about nine miles from its port, Port Chalmers, with which it is connected by railroad. It was founded by an association of Scottish Free Churchmen in 1848. It is reputed to be one of the finest residential towns in New Zealand. There is a university opened in 1871, with four faculties. Gold discovered nearby in 1861 has caused the recent rapid growth of the town. Wool and gold are the staple exports. Pop. 64,237.

DUNFERMLINE, Scotland, a royal burgh in Fife, 16 miles northwest of Edinburgh by rail. It is situated in a rich coal district, has brass- and iron-works, and important lines of manufactures. Andrew Carnegie, the Pittsburgh ironmaster, a native of the burgh, has furnished it with a public library and baths, presented it with the adjoining Pittencrieff Park and Glen, and otherwise liberally endowed it. Dunfermline is a place of great antiquity; its palace was a favorite residence of the Scottish kings; and in its abbey eight kings and seven queens were buried. The royal palace, now in ruins, is said to have been built by King Robert Bruce. The abbey was founded by Malcolm Canmore and his consort, Saint Margaret, in 1072, rebuilt by David I in the early Norman style, burned by Edward I of England in 1303, and its ruin completed by the iconoclastic zeal of the Reformers on 28 March 1560. The body of King Robert Bruce was laid in front of the high altar, a location now occupied by the pulpit of the Abbey church. The burgh boundaries were extended in 1911 southward to the fringes of the Firth of Forth. Dunfermline gives its name to a group of parliamentary burghs returning one member to the House of Commons. The linen and linoleum factories of the Dunfermline district are among the most important in Scotland. Two of the linen mills contain about 2,000 looms each and the other six from 600 to 1,800 looms each. The assessed valuation of the city for 1916–17 was $825,000, as compared with $755,000 for 1915–16. Pop. 28,103.

DUNG-BEETLE, a name borne by several lamellicorn beetles, of the genera *Aphodius, Bolbocerus, Copris, Geotrupes, Phaneus* and others. These beetles nest and lay their eggs in the droppings of cattle, and are found throughout America, Europe, Asia and Africa. An African species is the sacred scarabæus of Egypt (*Ateuchius sacer*).

DUNGARVAN, Ireland, municipal borough and seaport in the county of Waterford, 28 miles southwest of Waterford. It is a resort for sea-bathing. Its ancient castle, situated in the centre of the town, is now used as a barrack. The harbor is shallow and there is little trade. Fishing is the chief occupation. Pop. 4,977.

DUNGENESS, dŭnj'nes, a headland on the south coast of Kent, 11 miles southeast of Rye. It has a fort and government lighthouse.

DUNGLISON, dŭng'lĭ-sŏn, **Richard James,** American physician: b. Baltimore, Md., 13 Nov. 1834; d. Philadelphia, 4 March 1901. He was a son of Robley Dunglison (q.v.). He was graduated at the University of Pennsylvania 1852, and from Jefferson Medical College 1856. During the Civil War he served as surgeon in the Philadelphia military hospitals. He soon gave up the practice of medicine in order to devote himself to literary work and it is by his contributions to medical literature that he is best known, having edited the *College and Clinical Record* (1880–99) and written constantly for the leading medical journals. He was also one of the original editors of the Philadelphia *Medical Times.* He revised and edited the following works of his father: 'History of Medicine' (1872), and 'Medical Lexicon' (1874); translated Guersant's 'Surgical Diseases of Children' (1873); and was author of 'The Practitioner's Reference Book' (1878); 'Elementary Physiology' (1879); 'The Present Treatment of Disease' (1886).

DUNGLISON, Robley, American physician: b. Keswick, England, 4 Jan. 1798; d. Philadelphia, 1 April 1869. He was educated in medicine at London and Erlangen, and appointed professor of medicine in the University

of Virginia in 1824. In 1833 he was elected to the chair of therapeutics in the University of Maryland, and in 1836 professor of the institutes of medicine in the Jefferson Medical College of Philadelphia. He published about 20 volumes treating of subjects connected with medical science. They were widely circulated and highly valued in their day, one of them, a 'Dictionary of Medical Science and Literature,' being republished as late as 1874.

DUNITE, a heavy, dark, very basic igneous rock of the peridotite group. It contains no felspar and consists essentially of olivene and chromite. It is believed that most workable deposits of chrome iron ore were formed by local segregations of chromite in a cooling dunite magma, at least the chromite deposits of North Carolina probably had such an origin. Dunites in common with other rocks of the peridotite group change readily to serpentine, and most deposits of chromite occur in serpentine. See PERIDOTITE.

DUNKARDS. See GERMAN BAPTIST BRETHREN.

DUNKIRK, dŭn'kĕrk (Fr. *Dunkerque* or *Dunquerque*), France, a strongly fortified town in the department of Nord, on the coast of the North Sea, 28 miles northeast of Calais, at the junction of several canals. Of the public squares, that of Champ de Mars and that adorned by a statue of Jean Bart (1845) are the most noteworthy. There are several interesting churches, among the chief being the church of Saint Eloi, built about 1560, with a fine tower about 300 feet high, now used as a belfry; the chapel of Nôtre-Dame des Dunes, founded in 1405 and restored in 1815; and the convent and church of Saint Jean-Baptiste. Dunkirk is well protected by several forts, both on the land side and on that of the sea. Its manufactures are extensive, comprising fishing-nets, ropes, sailcloth, straw hats, starch, soap, leather, earthenware, oil and chemicals, besides distilling, sugar-refining, shipbuilding and other industries. Dunkirk is the third seaport of France, has four dry docks and five miles of quayage, chief port of departure of the Iceland fishing fleets. The trade is extensive and important. Dunkirk is the seat of a United States consular agent. Dunkirk was a town under its present name, which means "the church of the dunes," in the 9th century. It has played a prominent part in many wars, has been besieged on many occasions and successively held by Burgundy, Austria, Spain and France. Turennés victory of the dunes in 1658 brought it into the possession of France, by whom it was ceded to England. In 1662 it was bought back from Charles II. Under the Treaty of Utrecht (1713) its fortifications were to be demolished; but these were subsequently rebuilt. It was unsuccessfully besieged by the Duke of York in 1793. The present commercial importance of Dunkirk dates from the period of the Second Empire. One of the most famous natives of the town is Jean Bart (1651–1702), the celebrated seaman. Pop. of commune 38,891.

DUNKIRK, N. Y., city and port of entry in Chautauqua County, 41 miles southwest of Buffalo, on Lake Erie, and on the Lake Shore and Michigan Southern, the Pennsylvania, the Erie and other railroads. Its lake trade is extensive, facilitated by its fine harbor and breakwater. The important industries are the manufacture of locomotives, steel, axes, radiators, gas-engines, lumber, cotton goods, etc. The United States cenusus of manufactures for 1914 showed within the city limits, 62 industrial establishments of factory grade, employing 3,471 persons; of whom 2,989 were wage earners, receiving annually $2,108,000 in wages. The capital invested aggregated $9,354,000, and the year's output was valued at $8,367,000; of this, $4,303,000 was the value added by manufacture. The chief buildings are the high school, the public library and the Brooks Memorial Hospital. Gratiot Park and Washington Park are also attractive features. There are two national banks. The property of the town is assessed at approximately $10,000,000. The first settlement at Dunkirk was made in 1809. With the rapid increase in population, it was incorporated as a village in 1837, and in 1880 was chartered as a city. The government is conducted by a mayor, elected biennially, under whom appointments are made to the civil service commission and to the board of health; and by a common council consisting of five members. The city owns and operates its own waterworks, electric plant and power plant. Pop. 17,870.

DUNLAP, William, American dramatist and painter: b. Perth Amboy, N. J., 19 Feb. 1766; d. New York, 28 Sept. 1839. He painted George Washington's portrait and for five years (1784–89) worked under West in London. Returning to America he wrote several successful plays, including 'The Father' (1789), a comedy; 'Leicester' (1794), a tragedy; 'André' (1798), a tragedy. He also published 'Life of George Frederick Cooke' (1813); 'Life of Charles Brockden Brown' (1815); 'History of the American Theatre' (1832); 'History of the Rise and Progress of the Art of Design in the United States' (1834); and similar works. He was one of the founders of the National Academy of Design.

DUNLIN (*Tringa alpina*), a bird of the genus to which the least and pectoral sandpipers, knot and stint belong. It is smaller than the common snipe; is in winter ashy-gray above, white below, with dark spots on the breast; in the breeding season it is mottled with rufous above and the breast is crossed with black. The straight bill is adapted for boring in soft soil and its cavity reaches to the extremity, not, as in the snipe, stopping short of the tip. The dunlin is one of the most common shore birds in northern Europe and Asia, and sometimes wanders into North America, where it is replaced by the closely allied redbacked sandpiper. In Scotland there are several local varieties, those of the east being a half larger than those of the Hebrides. It breeds on moors and marshes along with the snipe and plover, returning after the breeding season to the sandy and muddy reaches of the coast. See SANDPIPERS.

DUNMORE, John Murray, EARL OF, English colonial governor; b. 1732; d. Ramsgate, England, May 1809. He was appointed governor of New York in 1770, and in addition governor of Virginia in 1771. He dissolved the Virginia assembly in 1772, and again in 1774 when it had resolved to keep the day of the closing of the port of Boston as a day of fasting and prayer. In 1775 he removed part of a

powder magazine to one of the English war ships, and the people, incensed at this, began armed resistance under the leadership of Patrick Henry. Dunmore was forced shortly after to take refuge on his fleet, whereupon the burgesses decided that he had abdicated his functions and refused to consult with him. He then kept up a predatory warfare against the colonists, burning Norfolk in 1776. He was driven from his position on Gwynn's Island and finally sent the fleet to the West Indies, and returned to England. He was elected a Scottish representative peer in 1776 and was governor of the Bahamas from 1787–96. See COLONIAL WARS IN AMERICA.

DUNMORE, Pa., borough in Lackawanna County, on the Erie and Lackawanna railroads, and two miles northeast of Scranton. It is the centre of a coal mining district, and has manufactures of silk, iron and brick. Several public institutions are located here, the principal one being the State Oral School for the Deaf and Dumb. Under a charter of 1862 the government is vested in a burgess elected every four years, a borough council and administrative officials, the majority of whom are chosen by popular vote. Dunmore was settled in 1835 and incorporated in 1862. Pop. 19,757.

DUNMOW, Great and Little, two parishes of England, in the county of Essex. The former (pop. about 3,000) contains the market-town of Great Dunmow, on a height above the Chelmer, 32 miles northeast of London. At Little Dunmow (pop. 320) are remains of a stately Augustinian priory, founded in 1104. The Dunmow flitch of bacon was a prize instituted in 1244, by Robert Fitzwalter, on the condition "that whatever married couple will go to the priory, and kneeling down on two sharp-pointed stones, will swear that they have not quarreled nor repented of their marriage within a year and a day after its celebration, shall receive a flitch of bacon." The prize was first claimed in 1445, 200 years after it had been instituted. After 1751, up to which date only five presentations had taken place, the flitch was not again claimed till 1855; between 1860 and 1877 there were four awards; and within recent years there have been recurrent awards. Consult Andrews, 'History of the Dunmow Flitch' (London 1877).

DUNN, Andrew Hunter, Canadian bishop: b. Saffron Walden, Essex, England, 1839; d. 1915. He was graduated at Corpus Christi College, Cambridge, was ordained to the priesthood in 1865 and elected Anglican bishop of Quebec in 1892. He was the author of 'Helps by the Way'; 'Thoughts for Quiet Moments.'

DUNN, Gano, American electrical engineer: b. New York, 18 Oct. 1870. In 1889 he was graduated at the College of the City of New York and two years later from the engineering department of Columbia University. He was for some years in the employ of the Western Union Telegraph Company and subsequently (1891) was with the Crocker-Wheeler Company, of which he was vice-president and chief engineer from 1898 to 1911. In 1911–13 he was vice-president in charge of engineering and construction of J. G. White and Company, New York, and since 1913 has served as president of the J. G. White Engineering Corporation. He was president of the New York Electric Society in 1900–02; of the American Institute of Electrical Engineers in 1911–12 and of the United Engineering Society 1913–16. He was American delegate and vice-president of the International Electrical Congress at Turin 1911. He has published various papers on electrical subjects.

DUNN, Jacob Piatt, American journalist and author: b. Lawrenceburg, Ind., 12 April 1855. He was educated at Earlham College, Indiana, and Michigan University, and was State librarian of Indiana 1889–93, when he became an editorial writer on the Indianapolis *Sentinel;* city comptroller of Indianapolis, 1901, 1904–05, 1914–16; member Public Library Commission of Indiana 1899–1916; member Commission on Taxation of Indiana 1916. Since 1886 he has been secretary of the Indiana Historical Society. He has published 'Massacres of the Mountains, a History of the Indian Wars of the Far West' (1886); 'History of Indiana' (1888), in the 'American Commonwealth Series'; 'The Tax Law of Indiana and the Science of Taxation' (1891); 'The Libraries of Indiana' (1892); 'The World's Silver Problem' (1894); 'True Indian Stories' (1908); 'History of Indianapolis' (1910); 'The Unknown God' (1914).

DUNN, Samuel Orace, American editor: b. Bloomfield, Iowa, 8 March 1877. He was graduated at the Pratt (Kan.) High School in 1894. He learned the printer's trade in 1890–95; was editor of the Quitman (Mo.) *Record* 1895–96; associate editor of the Maryville (Mo.) *Tribune* 1896–1900; reporter of the Kansas City *Journal* 1900–02, and editorial writer on the latter journal in 1902–04. In 1904–07 he was railroad editor and editorial writer on the staff of the Chicago *Tribune;* in 1907–08 he was managing editor of the *Railway Age,* and since 1908 editor of the *Railway Age Gazette.* He has published 'The American Transportation Question' (1912); 'Government Ownership of Railways' (1913), and contributions on transportation subjects.

DUNNAGE, a nautical term applied to loose wood or other miscellaneous substances used in the hold of a ship to lift the cargo above bilge-water. Also, such articles as old mats or sails stowed among casks and other cargo to prevent their motion and breakage. See CHOCK.

DUNNE, Edward Fitzsimons, American political leader: b. Waterville, Conn., 12 Oct. 1853. He took a three-year course at Trinity College, Dublin, was admitted to the bar in 1877 and became circuit judge of Cook County, Ill., in 1892. He remained in this relation until 1905 when he resigned to become mayor of Chicago. He was engaged in law practice from 1907 to 1913, and in 1913 was elected governor of Illinois for a four-year term. He is vice-president of the National Civic Federation and was president of the League of American Municipalities in 1906–07.

DUNNE, Finley Peter, American journalist and humorist: b. Chicago, 10 July 1867. He was educated in the Chicago public schools and entered journalism in 1885. He was city editor of the Chicago *Times* 1891–92; was on the editorial staff of the Chicago *Evening Post* and *Times-Herald* 1892–97, and editor of the Chi-

cago *Journal* 1897–1900. His literary fame began with his "Mr. Dooley" sketches which appeared first in the *Times-Herald*. They consisted of monologues by Mr. Dooley, a saloonkeeper of Archey Road, on various topics of the day. His comments were witty, keen and penetrating, mellowed by a kindly, tolerant, philosophic interest in the weaknesses of his fellow creatures. Homely similes and characteristic Irish-American brogue and humor enliven the essays. During the Spanish-American War, "Mr. Dooley's" words attacked its political and social phases, and were widely read both in England and America. 'Mr. Dooley in Peace and War' contains the best of these more satirical essays, whose popularity rank Dunne among the leading American humorists. He also published 'Mr. Dooley in the Hearts of His Countrymen' (1898); 'Mr. Dooley's Philosophy' (1900); 'Mr. Dooley's Opinions' (1901); 'Observations of Mr. Dooley' (1902); 'Dissertations of Mr. Dooley' (1906); and 'Mr. Dooley Says' (1910).

DUNNET HEAD, a promontory of Scotland, in Caithness, at the western entrance of and projecting into the Pentland Firth; the most northerly point of the mainland of Great Britain. It rises to the height of 400 feet above sea-level. On the northwestern extremity is a lighthouse 346 feet high.

DUNNING, Albert Elijah, American editor: b. Brookfield, Conn., 5 Jan. 1844. He was graduated at Yale University in 1867 and at Andover Theological Seminary in 1870. From 1871 to 1881 he was pastor of the Highland Congregational Church, Boston, and from 1881 to 1889 he served as general Sunday-school secretary for Congregationalist churches. From 1889 to 1911 he was editor-in-chief of the *Congregationalist*. He has at various times conducted parties of tourists to the Holy Land. He has published 'The Sunday School Library' (1883); 'Bible Studies' (1886); 'Congregationalists in America' (1894); 'Making of the Bible' (1911).

DUNNING, William Archibald, American educator: b. Plainfield, N. J., about 1859. He was graduated at Columbia 1881 and became successively Fellow 1886–88; prize lecturer in political science 1887–89; instructor in history 1889–91, and professor of history and lecturer on political theory since 1891. In 1894 he became managing editor of the *Political Science Quarterly*, to which he has contributed over 60 important articles and reviews. In 1913 he was president of the American Historical Association. He has published 'Essays on the Civil War and Reconstruction, and Related Topics' (1898); 'History of Political Theories, Ancient and Mediæval' (1902); 'History of Political Theories from Luther to Montesquieu' (1905); 'Reconstruction, Political and Economic' (1907); 'Carl Schurz's Political Career 1869–1906' (1908); 'Paying for Alaska' (1912).

DUNNOTTAR, dŭn-nŏt'tar, a parish of Kincardineshire, Scotland, famous for its ancient ruined castle perched on a great rock 160 feet sheer above the sea, one and one-half miles below Stonehaven. The older part of the ruins probably belongs to about 1394, when the castle was rebuilt by Sir William Keith, marischal of Scotland. During the Commonwealth the castle was selected as the strongest place in the kingdom for the preservation of the Scottish regalia. Lambert, one of Cromwell's generals, besieged the place, which was starved into capitulation. The regalia had, however, been previously removed by a stratagem, in which Mrs. Granger, the wife of the minister of an adjoining parish, played the chief part. She brought away the crown hid among some clothes in her lap, her servant-maid carrying the sword and sceptre in a bag of flax on her back. In the Whigs' Vault of the castle 176 Covenanters belonging to the west of Scotland, men and women, were confined in 1685. In Dunnottar churchyard Sir Walter Scott met Robert Peterson, the original of 'Old Mortality.' Pop. 2,255.

DUNOIS, dü-nwä', **Jean,** COUNT OF ORLEANS AND OF LONGUEVILLE, French soldier: b. Paris, 23 Nov. 1402; d. Saint Germain-en-Laye, near Paris, 24 Nov. 1468. He was a natural son of Louis, Duke of Orleans, and made the name "Bastard of Orleans" illustrious by his military exploits in the war for the liberation of France, then completely in the power of England. Being besieged by the English he defended Orleans with the greatest courage until relieved by the Maid of Orleans. To Dunois belongs almost entirely the honor of expelling the enemies of his country from Normandy and Guienne. In 1450 he had completely freed northern France from the presence of the English, and in the following year, among other cities, captured Bordeaux and Bayonne. Charles VII was indebted to him for his crown. Dunois received from him the title of "deliverer of his country," the county of Longueville and the dignity of high chamberlain of France.

DUNOON, dŭn-oon', Scotland, a celebrated watering-place in the county of Argyle, on the shore of the Firth of Clyde, 25 miles west by north from Glasgow. There is an immense passenger traffic here in the summer season, carried on by means of the Clyde steamers. On a hill are the ruins of Castle Dunoon, the ancient residence of the Argyles. A monument has been erected to the memory of Burns's 'Highland Mary,' who was a native of Dunoon. Pop. 6,859.

DUNOYER, dŭn-wä-yā, **Charles,** French economist: b. Carennac (Lot) 1786; d. Paris 1862. He studied law at Paris, then assisted in preparing Sirey's 'Recueil de Jurisprudence.' He welcomed the fall of the Empire, though he only accepted the legitimist monarchy so far as it respected the liberties of the people. In conjunction with Charles Comte he established in 1814 the journal named *Le Censeur*. It was discontinued in 1816 but resumed publication after 18 months as *Le Censeur Européen*. The increasing severity of the press laws, however, seriously hampered its editors and in 1820 it suspended publication. Thereafter Dunoyer devoted his attention to economics. He gave at Paris in the Athenæum Institute a course of lectures on political economy and moral science, which were afterward published as 'L'industrie et la morale considérées dans leurs rapports avec la liberté' (1825). In 1830, on the issuance of the *Ordonnances de Juillet* Dunoyer protested and turned to Louis Philippe, whose accession to power he welcomed. Appointed prefect of

Allier he was transferred in 1832 to the prefecture of the Somme; this he quitted in 1838 to enter the council of state. This last post was better suited to his disposition, which, though calm, was full of energy and ill-adapted to the compromising attitude necessary to a practical politician. In 1830 he reprinted his volume of 1825 with many additions, under the title of 'Nouveau traité d'économie sociale' (2 vols.), but before the second volume was issued from the press a fire consumed nearly the whole edition. Extending the scope of the work Dunoyer reissued the work in 1848 under the title 'De la liberté du travail ou simple exposé des conditions dans lesquelles les forces humaines s'exercent avec le plus de puissance' (3 vols.). He also contributed to the *Revue Encyclopédique*, the *Revue Française, Journal des Débats* and the *Journal des Economistes*. The revolution of 1848 was a heavy blow to him; he remained, however, on the council of state, and only relinquished his seat there after the *coup d'état* of 1851. Bitterly hostile to the second Empire, as he had been to the first, he wrote a work directed against the new order of affairs. This book, which was published after his death, and then only at Brussels, is entitled 'Le second empire et une nouvelle restauration' (2 vols., 1865). In 1832 he was elected member of the Institute and in 1845 president of the society of political economy. His miscellaneous works — 'Notices d'économie sociale' — and the second edition of 'La liberté du travail' appeared in 1886 (3 vols.). Dunoyer was one of the great economists of the 19th century. He was a supporter of Malthus on population, but he was no believer in the theory of rent, considering that there was but one factor in production, i.e. labor.

DUNQUERQUE. See DUNKIRK, FRANCE.

DUNRAVEN, Windham Thomas Wyndham-Quin, 4th EARL OF: b. Adare Abbey, Ireland, 12 Feb. 1841. He was educated at Christ Church, Oxford; was war correspondent for the *Daily Telegraph* in Abyssinia in 1867 and again in the Franco-Prussian war, and succeeded to the title in 1871. He was undersecretary for the Colonies, 1885–86, 1886–87. He is a traveler and yachtsman and has published: 'The Great Divide: the Upper Yellowstone' (1874); 'The Irish Question' (1880); 'Self Instruction in the Theory and Practice of Navigation' (1900); 'The Legacy of Past Years' (1911); 'Canadian Nights' (1914).

DUNS SCOTUS, Johannes, one of the greatest of the mediæval schoolmen, b. either in 1274 or 1266, probably in Ireland; d. Cologne 1308. Early in life he entered the Franciscan order, and studied at Oxford under William Ware. He was also influenced by Roger Bacon. About 1294 he taught at Oxford and defended the dogma of the Immaculate Conception. In 1304 he went to Paris, and in 1308, by the order of his superiors, to Cologne. The extreme delicacy and intricacy of his dialectic won him the title of the Subtle Doctor. He was less a systematist than a critic and attacked most of his contemporaries and immediate predecessors, especially Saint Thomas. He starts from the same initial stock of notions as Saint Thomas, but makes a different application of these notions. One of the most important principles of Scotism is that theology, unlike philosophy, is not a speculative but a practical science — the science of conduct, and that philosophy is definitely subordinate to theology. Scotism adds to the two forms of matter of the Thomists — that possessing only primary qualities and that also endowed with secondary qualities — a third, unqualified, *tabula rasa* matter, the same in both spiritual and corporeal substances. There are a hierarchy of forms of increasing degrees of specification. The substantial character of whatever is individual has its origin in nature, while that of the universal is derived from reason. The faculty of will is pre-eminent over that of intelligence, and that it is always possible to will the evil. This priority of the will applies to God himself, and the good consists solely of the decrees of the Divine will. The soul is the form of the body, but not the same form that endows it with its organic structure.

Scotus became the founder of the traditional philosophy of the Franciscans. Francis of Mayron (d. 1325) carried to a ridiculous extreme the excessive subtlety of his master. During the Revival of Learning the Scotists were strangely reactionary and opposed to the new studies, so that the word "Duns" or "Dunce" came to mean first "pedant" then "fool."

Scotus' most important work is the collection of his commentaries known as the '*Opus Oxoniense*.' The first complete edition of his works by one Luke Wadding appeared at Lyons in 1639 in 13 volumes (reprinted in 26 vols., Paris 1891–95). Consult De Wulf, M., 'Histoire de la philosophie medievale' (Paris 1905; tr. London 1909); Hagenback, C. R., 'History of Doctrines' (tr. 1880); Kahl, W., 'Die Lehre vom Primat des Willens der Augustinus Duns Scotus, und Descartes' (1886); Pluzanski, 'Essai sur la philosophie de Duns Scotus' (Paris 1887); Royce, 'Conception of God' (New York 1898); Stockl, 'Geschichte der philosophie des Mittelalters' (Mainz 1865); Werner, 'Duns Scotus' (Vienna 1881).

DUNSINANE, one of the Sidlaw Hills in Perthshire, 1,012 feet high, seven miles northeast of Perth. On its top are remains of an ancient fort locally known as "Macbeth's Castle." Here Siward defeated Macbeth in 1054. Shakespeare made use of this battle in his 'Macbeth.'

DUNSMUIR, James, Canadian statesman: b. Fort Vancouver, Wash., 8 July 1851. He was educated at Nanaimo, and Dundas, Ont., and has built up the mining interests in British Columbia which he inherited from his father. He was a member of the provincial legislature from 1898 to 1902; premier of British Columbia, 1900–02; and lieutenant-governor, 1906–09.

DUNSTAN, Saint, English prelate and statesman: b. Glastonbury about 924; d. Canterbury, 19 May 988. His family was a notable one and related to the royal line of the Anglian kings. He was educated in whatever of science and liberal arts existed in that time, by certain Irish scholars settled at Glastonbury, and he was proficient in music (including music composition), in painting and the mechanic arts. At an early age he entered the service of King Athelstan and continued in that of his successor Edmund, but his superior accomplishments provoked the enmity of his rivals at court, by

whom he was set upon with outrageous violence and driven out. He then went to his uncle, Ælphea, bishop of Winchester, and when convalescent from an attack of brain fever, took the religious vows, became a monk and was noted for his rigorous asceticism.

At the age of 22 he was made abbot of Glastonbury by King Edmund, who also appointed him principal state treasurer. Under Edmund's successor Edred (946–55), who was of feeble constitution, Dunstan was in all but name ruler of the kingdom and a wise and vigorous administrator. Under Edwy, who succeeded Edred, he courageously sought out the king while he was in the company of his destined bride, Elgiva, and to his face denounced the intended union as incestuous. For this action he was outlawed and spent two years in Flanders; but when Edwy's brother Edgar, a youth, became king of Mercia and Northumberland, he chose Dunstan for his chief minister and at the same time (957) was appointed bishop of Winchester; also held the see of London from 959; and in 961 he was promoted to the primatial see of Canterbury. He dispossessed all married and concubinary priests, supplanting them with monks where he could, made the canons of his own cathedral chapter a monastic college and raised the standard of monastic life. It was part of his policy to make the Danish inhabitants an integral part of the nation; he introduced civil order and preserved external peace. Edgar's successor, Edmund, owed chiefly to Dunstan his elevation to the throne, and the archbishop continued still to be principal minister of state; but when Edmund was murdered, 979, the archbishop's influence, under his successor, Ethelred, "the unready," was small, and disasters befell the kingdom thick and fast; the Danes ravaging the coasts and pillaging and slaughtering the people inland. The archbishop passed the closing years of his life in retirement, going back to the favorite studies and pursuits of his youth — music, painting, calligraphy, the making of musical instruments, and bell-founding. Consult Stubbs, 'Memorial of Saint Dunstan'; Butler, 'Lives of the Saints'; Starr, 'Patron Saints'; Wright, 'Biographia Literaria,' Vol. 1; Osbern; Eadmer.

DUNSTER, Henry, 1st president of Harvard College: b. Bury, Lancashire, England, about 1612; d. Scituate, Mass., 27 Feb. 1659. He was educated at Magdalene College, Cambridge, where he was associated with John Milton and Jeremy Taylor. He came to Massachusetts in 1640. He was inaugurated president of Harvard College 27 Aug. 1640, and held his office until 1654, when, having become a supporter of the principles of the modern Baptists, he was persuaded to resign his office. He was respected as a modest and pious man, and esteemed an excellent Oriental scholar. Consult Chaplin, 'Life of Henry Dunster' (Boston 1872).

DUNTON, John, English bookseller and author: b. Graffham, Huntingdonshire, 4 May 1659; d. 1733. He was apprenticed to Thomas Parkhurst, bookseller, in London, but ran away. On his return he began to be very interested in his work, and his bookshop flourished. In 1686 he visited New England, where he sold books and made observations on the new country. After he returned to England, he reopened his business and published the weekly *Athenian Mercury* (1690–96) and in 1717 planned to launch another weekly with Defoe. His accumulated debts and troubles unbalanced his mind slightly. He was the author of numerous political pamphlets in support of the Whigs. His greatest claim to remembrance is his book 'Life and Errors of Dunton' (1705), a curious jumble of nonsense and valuable sketches of the literary and political life of the period. His 'Letters from New England' (ed. by Whitmore, New York 1867) are of historical value also.

DUNWOODY, Henry Harrison Chase, American meteorologist: b. Highland County, Ohio, 23 Oct. 1842. He was graduated at the United States Military Academy in 1866 and from the Columbia Law School in 1876 and having been detailed in 1872 for duty on the signal corps was appointed in 1891 to the weather bureau, then first constituted. His special work has been that of formulating official forecasts of the weather, and he originated the system of cold wave warnings; in this connection he recommended the organization of State weather services. He is the author of many papers on meteorological subjects published by the signal service. He was made colonel in 1898, and was retired as brigadier-general in 1904.

DUODECIMAL SCALE. See ARITHMETIC.

DUPANLOUP, dü-päṅ-loo, **Félix Antoine Philibert,** fā-léks fē-lē-bĕr, French prelate and theologian: b. Saint Felix, Savoy, 3 Jan. 1802; d. Lacombe, Isère, 11 Oct. 1879. He was for a time tutor to the princes of the house of Orleans. In 1837 he became one of the vicar-generals of the archdiocese of Paris, and head of the Petit Séminaire de Saint Nicolas de Chardonnet. Dupanloup took a lifelong interest in charitable projects and in measures for extending to the masses the benefits of education. He combated the endeavors of that party in the Church which sought to displace in institutions of higher education the ancient Greek and Latin classics as pagan, and to substitute in their room the Fathers of the Church. He was made bishop of Orleans 1849; was elected to the French Academy 1854; but withdrew in 1871 when against his earnest protest Littré, the leader of the Positivists, was chosen to be a member; he became leader of the clericals in the National Assembly. In the Vatican Council he opposed the decree of infallibility, but was one of the first to make an act of submission. Nominated 1871 to be archbishop of Paris, he declined that office. He was a great pulpit orator, worthy of a place beside the great sacred orators of France. His writings are voluminous, dealing almost wholly with questions of education and church interests. Two of his works which are in every good pedagogical library are 'The Child' and 'The Ministry of the Catechist.' Consult Pelletier, 'Monseigneur Dupanloup.'

DUPATY, dü-pä-tē, **Charles Marguerite Jean Baptiste Mercier,** French jurist: b. La Rochelle, France, 9 May 1746; d. Paris, 17 Sept. 1788. In 1767 he became advocate-general to the parliament of Bordeaux, and having written in its name against the Duke of Aiguillon, when this nobleman became minister (1770), he was

sent to Pierre-en-Cise (a fortress at Lyons, once a state prison), and afterward banished until the accession of Louis XVI. The memorial by which he preserved the lives of three innocent citizens of Chaumont who were condemned to the wheel deserves particular mention. His other works are 'Reflexions historiques sur les loix criminelles,' a valuable work; various 'Discours académiques'; and 'Lettres sur l'Italie en 1785,' which appeared in 1788.

DUPATY, Louis Marie Charles Mercier, French sculptor and painter: b. Bordeaux, 29 Sept. 1771; d. Paris, 12 Nov. 1825. He was a son of the preceding. He was a member of the Institute, and professor in the École des Beaux Arts; was at first an advocate, served during the Revolution as a dragoon, then as cartographer, and finally went to Rome, where he studied sculpture and made himself known by numerous works. His principal productions are 'Ajax Pursued by Neptune,' his equestrian statue of Louis XIII (1816), and 'Orestes Pursued by the Furies.'

DUPERRON, dü-pĕ-rôn, **Jacques Davy,** French ecclesiastic: b. Saint Lô, Normandy, 15 Nov. 1556; d. Paris, 6 Sept. 1618. His father, a physician, having embraced the Reformed religion, had to flee from France and settled at Bern in Switzerland, where he became a Protestant minister. The son, having received at Bern a superior education, came to Paris at the age of 20, and having been there received into the Roman Catholic Church was appointed reader to the king, Henry III, and afterward adopted the clerical profession. He pronounced the eulogy of Mary Queen of Scots after her execution. He is said to have supported the Cardinal de Bourbon's plot to succeed to the throne after the death of Henry III, and to have betrayed its secrets to Henry of Navarre (Henry IV). He was appointed bishop of Erreuse, and was the agent in bringing about Henry's conversion to the Roman Catholic faith. He successfully checked the advance of Calvinism in his own diocese and brought seceders back to the Church. He was in Rome in 1604 when Clement VIII died, and was largely instrumental in securing the election first of Leo XI and then of Paul V, who in less than a month succeeded Leo. He was now made archbishop of Sens and cardinal. Contrary to the principles of Gallicanism, he was a zealous advocate of the doctrine of papal infallibility and of the papal supremacy over a general council of the Church. Consult Féret, 'Le Cardinal Duperron' (Paris 1877).

DUPETIT-THOUARS, dü-pĕ-tē too-ăr, **Abel Aubert,** French naval captain: b. Boumois, Saumur, 31 Aug. 1760; d. 1 Aug. 1798. When a mere boy he was so smitten with the love of a sea life by reading 'Robinson Crusoe' that he ran away from the military school of La-fléche and attempted to enter himself as a cabin-boy in a vessel at Nantes, but was discovered and sent back. At length, in 1778, he had an opportunity of entering the navy, and distinguished himself in the West Indies. On the expedition to Egypt in 1798 he commanded an 80-gun ship. He foresaw the only result which could be anticipated if it was resolved to wait for Nelson's attack in the roads of Aboukir, and advised immediately to set sail. But though his advice was disregarded he fought with undaunted valor against the enemy, and fell in the struggle. His MSS. and correspondence were published under the title of 'Letters, Mémoires et Opuscules d'Aristide Dupetit-Thouars.'

DUPIN, doo-păn', **Louis Ellies,** French church historian: b. Paris, 17 June 1657; d. there, 6 June 1719. In 1680 he received the degree B.D. at the Sorbonne, and in 1684 the degree D.D., and then or previously commenced those researches into the history of the Church which resulted in his celebrated 'Universal Library of all the Ecclesiastical Writers' (Vol. I, 1686). The freedom with which in this volume he discussed the teachings of the Fathers of the Church brought upon the work its condemnation by the archbishop of Paris and it was suppressed; but the author having made a retraction and changed "universal" in the title to "new," he was permitted to continue the series, though later he was banished as a Jansenist and permitted to return only after a new retraction. He sought to effect a union between the Anglican and Gallican churches and had a correspondence to that end in 1718 with the Anglican primate, Archbishop Wake. He was now charged with endeavoring to subvert the dogmas of the Roman Catholic Church, and his papers were seized in 1719, in the expectation that they would give proof of the charge; but nothing was found that seriously compromised him. He seems to also have conferred with Peter the Great with a view to union of the Gallican and Russian churches. The 'Library of Ecclesiastical Authors' is a voluminous work of immense erudition, rich in biographical sketches and in bibliographical details of theological literature in the Roman Church till the close of the 17th century; it was soon translated into English.

DUPLEIX, dü-plāks, **Joseph François,** French colonial governor: b. Landrecies, France, 1 Jan. 1697; d. Paris, 10 Nov. 1764. In 1720 he was appointed to a seat in the council at Pondicherry. Ten years later he became superintendent at Chandernagore in Bengal. The remarkable success of his administration here led to his being appointed, in 1741, governor-general of all the French Indies, with the title of Nawab. He now successfully pursued that policy of patient, skilful diplomacy among the native princes which at one time made the Carnatic almost a French province. When war broke out in Europe between France and England (1740), several brilliant engagements planned by Dupleix took place between the French garrison and the troops of the Nawab of the Carnatic, who endeavored to take possession of Madras, but was precipitately forced to raise the siege. An attack on the English at Fort Saint David failed, but Dupleix's science and courage were displayed in the defense of Pondicherry, which Admiral Boscawen in vain attacked for five weeks, with an apparently overwhelming force, but was forced to retire discomfited, though the defense was conducted by a civilian, unsupported by a single general of repute. The ambitious mind of Dupleix had long formed the project of founding a French empire in India on the ruins of the Mogul monarchy, but his military designs, able as they were, were frustrated by the energy and military

genius of Clive and Lawrence. The struggle continued till 1754, in which year Dupleix was recalled by Louis XV.

DUPONCEAU, dŭ-pŏn'sō, Fr. dü-pôń-sō, **Peter Stephen,** American lawyer and scholar: b. Saint Martin, Isle de Ré, France, 3 June 1760; d. Philadelphia, 1 April 1844. For a time he was secretary to Count de Gébelin, and afterward to Baron Steuben, with whom he came to the United States in 1777. Receiving a captain's commission he served with Steuben through the American Revolution and after its close settled in Philadelphia and became noted as a lawyer. For several years he was much interested in an effort to introduce into the United States the production and manufacture of silk. His writings are of a miscellaneous character, among which may be mentioned original treatises on points of law; translations from the Latin, German and French on similar subjects; various treatises on philology; numerous contributions to American history, including a translation of 'A Description of New Sweden,' by Thomas Campanius Holm. He was a member of more than 40 literary and scientific instiutions of Europe and America, including the American Philosophical Society, the Historical Society of Pennsylvania, and the Philadelphia Athenæum, of which three institutions he was the presiding officer at the time of his death.

DU PONT, dü-pŏnt', **Henry,** American manufacturer: b. Eleutherian Mills, near Wilmington, Del., 8 Aug. 1812; d. 8 Aug. 1889. He was the second son of Eleuthère Irénée Du Pont de Nemours (q.v.). He secured his early education at Constant's Mount Airy Seminary, Germantown, Pa.; in 1829 he entered the military academy at West Point, from which he was graduated in 1833. In the following year, however, in deference to his father's wishes that he should return to Delaware to master every detail of the powder business and so be well equipped to assist him, he resigned his commission and thereafter gave his attention to the powder industry. In 1850 he became head of E. I. Du Pont de Nemours and Company, and by his executive ability soon extended the operations of the works until the industry had assumed enormous proportions. The war with Mexico called for large quantities of powder from the mills and when peace came general enterprises began to demand still larger quantities in industrial operations. The company also supplied the English army during the Crimean War, and during the Civil War in the United States sold enormous quantities to the National government. Politically he was associated with the Whigs, but when the Civil War broke out he heartily supported Lincoln in all his measures to prevent the dissolution of the Union. He became one of the leaders of the Delaware Republicans and was a presidential elector in the campaigns of 1868, 1876, 1880, 1884 and 1888. He was appointed major-general of the Delaware forces in 1861 by Governor Burton, and immediately upon assuming office ordered every man in the military service of the State to take an oath of allegiance to the United States or surrender his arms. There were many people in the State who were undecided as to which cause to espouse and Du-Pont's order was calculated to compel the people to declare themselves, but influences adverse to Du Pont succeeded in inducing Governor Burton to suspend the order. Du Pont thereupon applied to Gen. John A. Dix, commanding the Federal troops at Baltimore, and the latter sent a body of troops to Delaware to maintain the supremacy of the general government in that State. Like his ancestors Henry Du Pont had a great attachment for rural life and agricultural pursuits, and was probably the largest individual landowner in the State. He was widely known for his many benefactions, took a lively interest in local affairs and was ever to be found in favor of public improvement.

DU PONT, Henry Algernon, American soldier and legislator: b. Eleutherian Mills, Newcastle County, Del., 30 July 1838. He is the son of Henry Du Pont and grandson of Eleuthère Irénée Du Pont (qq.v.). He entered the University of Pennsylvania in 1855, but spent only a year there and in 1856 entered the United States Military Academy, from which he was graduated in 1861, at the head of his class. Immediately after his graduation he was sent south, served in the defenses of Washington, May–July 1861 and in the 5th United States Artillery 1861–62, being promoted to adjutant in July 1861. In 1862–63 he was acting assistant adjutant-general of troops at Fort Hamilton, N. Y. In 1863 he was sent into active service in command of Light Battery B in the fields of Pennsylvania, Maryland, Virginia and West Virginia. He was promoted captain of the 5th Artillery in 1864, and took part in the battle of New Market. He was soon afterward appointed chief of artillery of the department of West Virginia and during Hunter's campaign against Lynchburg he commanded the artillery at the battle of Piedmont, 5 June 1864, at the engagement at Lexington 11 June, the affair near Lynchburg 17 June, the battle of Lynchburg 18 June and the affairs at Liberty 19 June and Mason's Creek 21 June. He served next in Sheridan's campaign in the valley of Virginia, commanding the artillery brigade of Crook's corps and participating in the affairs at Cedar Creek 12 August and Halltown 23, 25 and 27 August, the action at Berryville 3 September, the battle of Winchester (Opequan) 19 September, Fisher's Hill 22 September. For "distinguished services at the battle of Cedar Creek" he was brevetted lieutenant-colonel and was also awarded a medal of honor by Congress for "most distinguished gallantry and voluntary exposure to the enemy's fire at a critical moment" during the battle of Cedar Creek. After the war Du Pont continued in the army for a number of years, holding commands at Fort Monroe, Va.; Camp Williams, near Richmond; Washington, D. C. and Fort Adams, Newport, R. I. He was a member of the board of officers which assimilated the tactics for the three branches of the service. On 1 March 1875 Colonel Du Pont resigned from the army and after a year's absence in Europe went back to live in Delaware. In 1877 he became a director and in 1878 the president and general manager of the Wilmington and Northern Railroad Company, then in very bad physical and financial condition. After 21 years of incessant labor he was at last successful in putting the road into satisfactory shape. He also became associated with the celebrated powder mills established

near Wilmington, Del., by his grandfather, Eleuthère Irénée Du Pont, and which had proven an important factor in the Civil War. He retired from active business cares in 1902 and has since devoted his spare moments to agricultural pursuits. In 1895 he came into national prominence again because of the famous struggle with John Edward Addicks in Delaware for a seat in the United States Senate, a struggle which lasted nearly 20 years and resulted in several deadlocks. The contest finally ended with the election of Du Pont in 1906 for the unexpired term beginning 4 March 1905, and he took his seat in the Senate 3 Dec. 1906. In 1911 he was re-elected for the term ending 3 March 1917. Mr. Du Pont has published several contributions to the science of military tactics, among which are two volumes issued separately in 1875, entitled 'Cavalry Tactics U. S. A., Assimilated to the Tactics of Infantry and Artillery,' and 'Artillery Tactics, U. S. A., Assimilated to the Tactics of Infantry and Cavalry.' He is a member of numerous organizations including the Historical Societies of New York, Pennsylvania and Delaware, the American Philosophical Society, the American Geographical Society, the Society of Colonial Wars, the Huguenot Society and the Military Service Institute.

DU PONT, Samuel Francis, American naval officer: b. Bergen Point, N. J., 27 Sept. 1803; d. Philadelphia, 23 June 1865. He was the third son of Victor Marie Du Pont de Nemours. His parents removed to Louviers, Del., soon after his birth. In 1815 President Madison appointed him a midshipman in the navy. His first service was a voyage to the Mediterranean on the *Franklin*. In 1821–22 he served aboard the *Constitution* in the Mediterranean, and was next attached to the *Congress* for a cruise in the West Indies and off the coast of Brazil. He passed through the various grades reaching that of commander in 1842, when he was sent to China in the *Perry*, but ill health forced him to leave his ship at Rio Janeiro and return home. In 1845 he assisted in perfecting the organization and administration of the newly-founded Naval Academy at Annapolis. In the same year he was transferred to the *Congress* on the Pacific station under Commodore Stockton. On the outbeak of the Mexican War Du Pont was given command of the *Cyane*, and took a prominent part in all the operations on the California coast, clearing the Gulf of California of hostile vessels, and taking San Diego, La Paz and Mazatlan. He was ordered home in 1848, became a member of the Light-House Board, and in 1855 was made captain and member of the naval retiring board. In 1857 he visited China, Japan, India and Arabia, and in 1860 was placed in command of the Philadelphia navy yard. In September 1861 he was appointed flag officer and ordered to the command of the South Atlantic blockading squadron. In conjunction with Sherman's land forces he took Port Royal in November and established 14 blockading stations along the coast. He was next ordered to attack Charleston, S. C., which he did on 7 April 1863, but was repulsed with considerable loss. This was the last important engagement that occurred while Du Pont had command of the fleet, as he was relieved from command 5 July 1863. Admiral Du Pont was also favorably known as the author of various papers on professional subjects, among which were those on corporal punishment in the navy and on the use of floating batteries for coast defense. In 1882 Congress provided that "the circle at the intersection of Massachusetts and Connecticut Avenues" in the city of Washington should be called Du Pont Circle, and subsequently $20,500 was appropriated for the erection there of a bronze statue of the admiral which was modeled by Launt Thompson and dedicated 20 Dec. 1884.

DU PONT DE NEMOURS, Eleuthère Irénée, American manufacturer: b. Paris, 24 June 1771; d. Philadelphia, 31 Oct. 1834; son of the French political economist, Pierre Samuel Du Pont de Nemours. He was a pupil of Lavoisier and entered the royal powder mills at Essonne to familiarize himself with the manufacture of gunpowder with a view to succeed Lavoisier as superintendent of the government powder mills, but subsequently abandoned this in 1791 to take charge of the printing and publishing house established by his father in Paris. Being a supporter of King Louis XVI, he was in the utmost peril after 10 Aug. 1792, and after being three times imprisoned and having his printing house sacked and destroyed, he emigrated with his father's family to the United States in 1799, arriving at New London, Conn., 1 Jan. 1800. Not long after his arrival attention was called to the poor quality of gunpowder then made in this country and he determined to enter into powder manufacture here. With this in view he returned to France, January 1801, to procure at Essonne plans and models of improved machinery, returning to the United States in August with some of the machinery. Thomas Jefferson, who was deeply interested in this development, urged that the works be built in Virginia, but owing to his views regarding slavery and its effect on the white race Du Pont was unwilling to make his venture either in Virginia or Maryland. In June 1802 he bought a tract of land with a fine water-power on the Brandywine River, near Wilmington, Del. On 19 July he arrived there with his family and began operations which were so successful that, at the time of his sudden death by cholera, his works were the largest of their kind in the country. Since his death they have been carried on by his sons and grandsons and are still among the largest gunpowder works in this country, while they are the centre of the industrial combination in this industry. He found time also to join every movement tending to promote agricultural and industrial enterprises, and earnestly supported every measure looking toward local improvement. For some time he served as a director of the Bank of the United States; he took a prominent part in the work of the American Colonization Society, and also found time for other philanthropic labors and innumerable private benevolences.

DU PONT SMOKELESS POWDER, a hard-grained porous powder, composed of nitrocellulose of medium nitration which has been formed into grains by suspending the nitrocellulose in an aqueous solution of barium and potassium nitrates to which amyl acetate is added, stirring the gelatinized material in the fluid until the grains are formed and hardening

them by steam until the amyl acetate is expelled. A certain amount of vaseline is incorporated during the drying process in the dense powders and these powders are practically proof against atmospheric moisture. The grains may be separated by sifting into the various desired sizes and colored to meet any taste by the addition of a very small amount of an organic coloring matter. The Du Pont smokeless powders are offered in many kinds under four general classifications: (1) for high power rifles; (2) for black-powder rifles which have been adapted for smokeless powder; (3) for revolvers and automatic pistols at midrange and (4) for the same weapons at short range. See EXPLOSIVES; POWDER.

DUPONT, dü-pôn, **Jacques Charles,** surnamed *De l'Eure,* French statesman: b. Neubourg, Eure, Normandy, 27 Feb. 1767; d. Rouge-Pierre, Normandy, 3 March 1855. In 1789 he was an advocate at the parlement of Normandy. During the republic and the empire he filled successively judicial offices at Louviers, Rouen and Evreux. He had adopted the principles of the Revolution and in 1798 he was a member of the Council of the Five Hundred, which was dispersed by Murat on the 18th Brumaire. In 1811 he was nominated president of the Court of Justice at Rouen and in 1813 vice-president of the Corps Législatif. During the Hundred Days he was vice-president of the Chamber of Deputies and when the allied armies entered Paris he drew up the declaration in which the chamber asserted the necessity of maintaining the principles of government that had been established at the Revolution. He was one of the commissioners chosen to negotiate with the allied sovereigns. On the restoration of the Bourbons, Dupont signalized himself as a leader of the opposition. In 1830, after the revolution of July, he was made Minister of Justice, and after the fall of Louis Philippe became a member of the provisional government. In 1849 he failed to secure his re-election to the chamber and retired into private life and on the accession of Napoleon III, in 1852, he ceased to take part in public affairs. His consistent firmness in the cause of constitutional liberalism during the many changes of his times gained him the esteem of his countrymen, by whom he was styled "the Aristides of French liberalism."

DUPONT, Pierre, French song-writer: b. Lyons, 23 April 1821; d. Lyons, 24 July 1870. His parents both died before he was five years old and he was cared for in the country by his godfather, a village priest. He was educated at the seminary of L'Argentière and was afterward apprenticed to a notary at Lyons. He went to Paris in 1839 and published some poems in the *Gazette* and the *Quotidienne.* In 1841 he was saved from the conscription and through the help of Lebrun and a kinsman published his first volume, 'Les Deux Anges.' He was awarded a prize from the academy in 1842 and for a time was employed on the official dictionary. Gounod's admiration of a peasant song determined Dupont in his vocation as a song-writer. He possessed no musical knowledge and had to engage Ernest Reyer to write down his airs. He sang his own songs at the workmen's concerts in the Salle de la Fraternité du Faubourg Saint-Denis. The public performance of his famous 'Le Pain' was forbidden; 'Le chant des ouvriers' was even more popular and in 1852 his becoming the poet laureate of socialism proved obnoxious to the new government and he was condemned to be banished for seven years; but the intercession of friends soon procured his release and he withdrew for a time from participation in politics. He spent his later years in Lyons. His songs have appeared in various forms 'Chants et chansons' (3 vols., with music, 1852–54); 'Chants et poésies' (7th ed., 1862). The best known are 'Le Braconnier,' 'Le Tisserand,' 'La Vache blanche,' and 'La Chanson du blé.' Consult Baudelaire, Ch., 'Notice sur P. Dupont' (1849); Déchant, 'Biographie de Pierre Dupont' (1871); Lenient, Ch., 'Poésie patriotique en France' (1889); Sainte-Beuve 'Causeries du Lundi.'

DUPONT, Pierre Antoine, COUNT, surnamed DE L'ETANG, French soldier: b. Chabanais, 14 July 1765; d. Paris, 7 March 1840. He first served with Maillebois' legion in Holland and in 1791 was on the staff of the Army of the North under Dillon. By his skilful arrangement as a staff officer, he prevented Denmark from falling into the hands of the Duke of York and was promoted to the rank of brigadier-general. In 1797 he became general of division. After the proceedings of the 18th Brumaire, in which he took an active part, he was appointed head of the general état-major of the army of reserve assembled at the foot of the Alps and distinguished himself in Italy at the battle of Marengo. In the campaign of 1805 on the Danube, he earned further distinction by preventing the escape of the Austrians from Ulm, thus contributing largely to the capture of Mack and his army. He also freed Marshal Mortier from Russian troops. He was active in the campaign of 1806 against the Prussians and in 1807 contributed to the victory of Friedland. He entered Spain in 1808 at the head of a corps. After the occupation of Madrid, Dupont was created count by Napoleon and dispatched to subdue Andalusia. He was pursued and cut off by Castaños, his corps was defeated and on 22 July 1808 he felt himself constrained to capitulate with 18,000 soldiers at Baylera. After his return to France, Dupont was sent before a court-martial, deprived of his rank and title and imprisoned from 1812 to 1814. On the fall of Napoleon he was released and was given a military command by Louis XVIII, which he lost on the return of Napoleon. He was restored once more to the army after the final downfall of Napoleon and became a member of the Privy Council of Louis XVIII. From 1815 to 1830 he was member of the Chamber of Deputies from Charente. He went into retirement in 1832. He wrote some poems (1838) and verse translations from Horace (1836) and the military works 'Opinioin sur le nouveau mode de recrutement' (1818); 'Lettres sur l'Espagne en 1808' (1823); 'Lettre sur la campagne d'Autriche' (1826). Consult Titeux 'Le Général Dupont; une erreur historique' (Paris 1903).

DUPONT DE NEMOURS, Pierre Samuel, French economist: b. Paris, 14 Dec. 1739; d. Eleutherian Mills, near Wilmington, Del., 7 Aug. 1817. He was educated under his mother's tutelage and at an early age gained distinction in his studies, which included literature, medicine, engineering and military science, etc. He lived almost unknown in Paris as a private man of

letters till 1763, where he gained notoriety by his pamphlets which criticized a new scheme of taxation then under consideration. In 1768 he was appointed editor of *Les Éphémérides du Citoyen,* the organ of the economists, and to this and other papers he contributed many interesting articles and editorials advocating the liberty of the press, the abolition of slavery, the removal of all restrictions from commerce and labor, the suppression of the oppressive tax called "Corvée," and many other reforms. His efforts for reform fell under the displeasure of Abbé Terray, the Comptroller-General, and he was obliged to leave France. Several foreign princes offered him a reception and conferred honors upon him. In 1774 he was appointed secretary of the Council of Public Instruction by King Stanislaus Augustus of Poland with a commission to organize a system of national education. He had been engaged on this work but a short time when, later in the same year, Turgot became comptroller-general and Dupont was formally recalled to France and made inspector-general of commerce by Louis XVI. He now put into actual being many of the reforms which he had so long advocated, but was obliged to go into retirement when Turgot was succeeded by the Comte de Maurepas. In 1778 he was recalled to active duty by Necker, the successor of Maurepas. He now entered upon a long period of active service and came to be entrusted with important and delicate matters. Having always been an ardent advocate of the cause of American liberty, he was entrusted by the Count de Vergennes with the delicate mission of conducting the secret negotiations with the English representative, Dr. Hutton, which laid the basis for the peace treaty of 1783 by which Great Britain acknowledged the independence of the United States. Soon afterward Dupont was appointed a member of the Commission on Agriculture and in 1787–88 he was secretary-general of both assemblies of notables. At the beginning of the Revolution in France Dupont was a member of the States-General from Nemours and later represented that electorate in the Constituent Assembly, of which he was twice elected president. His chief work in the Assembly was the formation of radical fiscal reforms. After the dissolution of the Assembly he was for a time editor of the *Correspondence Patriotique* and issued several pamphlets upholding the new constitution and demanding the enforcement of the laws. Dupont and his son, Eleuthère Irénée, were among the defenders of the Tuileries on 10 Aug. 1792 when the populace attacked the palace clamoring for the overthrow of the king. He was now marked for destruction by the Jacobins, but managed to elude capture and finally retired to his home where he devoted himself to literary pursuits until his arrest on 20 June 1794. He was sentenced to the guillotine, and was saved from this fate only by the death of Robespierre, and was released on 24 August. He again attacked the Jacobins, in 1795 was elected a member of the Council of the Ancients, becoming president in 1797. When the Council was overthrown by the Jacobins Dupont was again imprisoned and his property confiscated. On his release in 1799 he emigrated with his family to America where he was received with great distinction. He established a banking house in New York which failed within a few years because of the refusal of the French government to reimburse the firm for funds advanced. In 1802 Dupont returned to France, but did not at that time take any political office, notwithstanding the offers made him by Napoleon. He was, however, instrumental in promoting the treaty of 1803 by which the United States purchased Louisiana and he was appointed one of the commissioners to arrange the formal transfer. Later he became secretary of the Paris Chamber of Commerce, and in 1807 was appointed sub-librarian at the Arsenal. After Napoleon's first downfall in 1814 he became secretary of the provisional government that prepared the return of Louis XVIII, and after the restoration of the Bourbons he was again named councillor of state. After Napoleon's return from Elba, Dupont was again forced to flee, settling in the United States where his two sons had already become citizens. Besides his political treatises he is likewise the author of a French translation of the first three cantos of the 'Orlando Furioso.'

DUPONT DE NEMOURS, Victor Marie, American manufacturer: b. Paris, France, 1 Oct. 1767; d. Philadelphia, Pa., 30 Jan. 1827. He was a son of Pierre Samuel Dupont De Nemours (q.v.), and entered the diplomatic service as attaché to the French legation in the United States in 1787; became secretary of legation in 1795 and was appointed French consul in Charleston, S. C., in the same year. In 1798 he was appointed consul-general of France in New York. He returned to France, was aide-de-camp to Lafayette, then commanding the national guard, later withdrew from the government service and came to the United States in January 1800. He entered business in New York; removed to Wilmington, Del., in 1809, where he joined his brother and established a cloth manufactory. During the War of 1812 he was captain of a company of Delaware volunteers. He was for a time a member of the Delaware legislature, and a director of the Bank of the United States.

DÜPPEL, düp'pĕl, Germany, fortified village in the province of Schleswig-Holstein, Prussia, on the peninsula of Sundewitt, 16 miles northeast of Flensburg, on the coast of the Little Belt. The place has been the scene of some severe struggles between the Danes, to whom it formerly belonged, and the Germans. In 1848 the latter were defeated here by the Danes, then the place was retaken by the Prussians, and in 1860 was again in possession of Denmark. After a long siege it was captured by the Prussians in 1864. Consult Neumann, R., 'Ueber den Angriff der düppeler Schanzen in der Zeit von 15 Marz bis 18 April 1864' (Berlin 1865).

DUPRAT, dü'prā', **Antoine,** French statesman, archbishop and cardinal: b. Issoire, 17 Jan. 1463; d. Rambouillet, 9 July 1535. He took high rank in the legal profession but on the death of his wife in 1507 entered the Church. Under Louis XII he was president of the Parliament of Paris, and in 1515, on the accession of Francis I, became Chancellor and Prime Minister. The chief event of his ministry was the conclusion of the concordat, against great clerical and academic opposition, by which the Church and nobility became subject to the

Crown, and by which he nullified the desire of Pope Leo X to abrogate the Pragmatic Sanction, which in 1438 had limited the spiritual power of the Pope in France and laid the foundation of the Gallican Church. In thus consolidating the power of the state he was the precursor of Richelieu and Mazarin. He was appointed archbishop of Sens in 1525 and cardinal in 1527. Consult his biography by the Marquis du Prat (Paris 1857).

DUPRÉ, dü-prā', **Giovanni,** Italian sculptor: b. Siena, Italy, 1 March 1817; d. Florence, 10 Jan. 1882. Among his works are 'Abel'; 'Cain'; 'Sappho'; 'Giotto'; and 'Pieta'; the last representing the dead Christ, supported by his mother. He received the gold medal at the Paris Exposition of 1867. His monument to Cavour 1866–73 was the least splendid of his works, chiefly because he proved his inability to execute large pieces. His work is virile and forceful. Consult his autobiography (1879, translated by Peruzzi 1884); and Frieze, 'Giovanni Dupré' (London 1886).

DUPRÉ, Jules, French landscape painter: b. Nantes, 5 April 1812; d. L'Isle Adam, 6 Oct. 1889. He began his career as a painter of porcelain in his father's factory, but when 18 years old went to Paris where his talent soon became recognized. He sent his first picture to the Salon in 1831; was made a Chevalier of the Legion of Honor in 1849, and officer in 1870. He received a second-class medal at the Exposition of 1867 and the same at the Exposition of 1883, and a medal of honor at the Exposition of 1889. In 1834 he visited England where he was greatly influenced by Constable. His studio for some years was in the Forest of Fontainebleau, and later in L'Isle Adam. A number of his pictures are owned in the United States. Dupré was one of the chief members of the Barbizon school. His favorite themes represent nature in its dramatic phases. Consult Clarétie, 'Peintres et sculpteurs contemporains' (Paris 1899).

DUPRÉ, Julien, French painter: b. Paris 1851; d. 1910. His masters were Pils and Henri Lehmann. He has been very successful in portraying simple scenes from country life, farm animals and landscapes. His 'Mowers of Lucerne' and 'White Cow' are in the Luxembourg. In 1904, at Saint Louis he exhibited one of his greatest works, 'The Return of the Herd,' and also 'Evening' and 'Near a Pool.'

DUPUIS, dü-pwē', **Charles François,** French scholar: b. Trie-Château, near Gisors, 16 Oct. 1742; d. Is-sur-Tille, France, 29 Sept. 1809. In his 24th year he was made professor of rhetoric at Lisieux. His 'Mémoire sur l'Origine des Constellations et sur l'Explication de la Fable par l'Astronomie' (1781) is erudite, but rather sophistical. Later works of his are 'Origine de tous les Cultes, ou la Réligion universelle' (1794), which gave rise to an embittered controversy; two works on the Pelasgi, which attracted great attention; treatises on the zodiac of Denderah, and on the Phœnix; 'Mémoire explicatif du Zodiaque chronologique et mythologique' (1806).

DUPUIS, Nathan Fellowes, Canadian scientist: b. Portland, Ontario, 13 April 1836. He graduated at Queen's University, Kingston, in 1866; was professor of chemistry in his alma mater, 1867–80, and of mathematics, 1880–1911. His published works include 'Elements of Geometrical Optics' (1868); 'Geometry of the Point, Line and Circle in the Plane' (1889); 'Elements of Synthetic Solid Geometry' (1893).

DUPUY, dü-pwē', **Charles Alexandre,** French statesman: b. Le Puy, Haute-Loire, 1851. He received his education at the Lycée of Le Puy and the Lycée Charlemagne, Paris. He was successively a professor of philosophy at the colleges of Nantua and Aurillac, and a teacher in lycées, school inspector for the academies of Lozère and Calvados and vice-rector of the college at Ajaccio, Corsica. In 1885 he entered the political arena, becoming deputy for Haute-Loire in 1885, and securing re-election in 1889. In 1892 he became Minister of Public Instruction and in the following year was chosen president of the Chamber of Deputies. He was twice Premier and Minister of the Interior, in 1893–95 and 1898–99. In 1900 he was chosen senator for Haute-Loire. He is the author of 'Livret de morale' (1891).

DUPUY, Jean, French journalist and politician: b. Saint-Palais, Gironde, 1844. In 1886 he became proprietor of the *Siècle* and two years later of the *Petit Parisien,* and afterward was head of the Paris press syndicate. In 1891 he took his seat in the senate as a Radical Republican and was prominent in the debates on agriculture and finance. In 1899–1902 he served as Minister of Agriculture in the Cabinet of Waldeck-Rousseau, and as Minister of Commerce in that of Briand, 1909–11. From January to March 1913 he served as Minister of Public Works.

DUPUYTREN, dü-pwē-trăn, **Guillaume,** BARON, French surgeon and anatomist: b. Pierre-Buffière, Haute-Vienne, 6 Oct. 1777; d. Paris, 8 Feb. 1835. In 1801 he obtained the situation of overseer of anatomical labors at Paris; and became in 1815 first surgeon to the Hôtel Dieu. In 1823 he was appointed first physician to the king, Louis XVIII, and retained the same situation under Charles X. He possessed extraordinary acuteness in respect of diagnosis, united with remarkable skill and dexterity in the most dangerous operations, in performing which he had a firmness of nerve which was never shaken. He invented several surgical instruments and modes of operation, and also made some discoveries in pathological anatomy. Some of his pupils united in publishing his 'Oral Lectures on Clinical Surgery' (1830–34); and his 'Theory and Practice as to the Treatment of Wounds by Warlike Weapons,' was published in 1834.

DUQUESNE, dü-kān, **Abraham,** French admiral: b. Dieppe 1610; d. Paris, 2 Feb. 1688. In his 17th year he was in the sea-fight off Rochelle, and distinguished himself during and after the year 1637 in the war against Spain. In 1647 he commanded the expedition against Naples. Bordeaux, which had rebelled, he reduced, notwithstanding the assistance afforded it by Spain. In the Sicilian War he thrice defeated the combined fleets of Holland and Spain, under the renowned De Ruyter, who was mortally wounded in the last engagement. After he had reduced Algiers and Genoa to the necessity of supplicating the mercy of Louis

XIV, the king conferred upon him the estate of Bouchet, and made it a marquisate, with the title of Duquesne. More than this he could not do, because Duquesne was a Protestant. He was, also, the only person exempted from the banishment of his sect, occasioned by the repeal of the Edict of Nantes.

DUQUESNE, dū-kān', Pa., borough, in Allegheny County; on the Monongahela River and the Pennsylvania Railroad; about 10 miles from Pittsburgh. A Carnegie library and institute are located here. The chief industries are the manufacture of steel and iron products. The first settlement was made in 1885, and it received its charter in 1891. The government is conducted by a burgess, elected triennially, and a borough council. The city owns and operates its waterworks. Pop. 18,567.

DUQUESNOY, dū-kān-wā, **François,** or «FRANÇOIS FLAMAND,» Flemish sculptor: b. Brussels 1594; d. Leghorn, Italy, 12 July 1646. He was taught by his father and became celebrated at an early age. His best works are child figures. Under the patronage of Urban VIII he carved the groups of children which adorn the altar at Saint Peter's, Rome; likewise the statue of Saint Andrew in the same church, Saint Susanna for the Santa Maria di Loreto, at Rome, and numerous others. At the invitation of Richelieu, he set out to the court of Louis XIII of France, but died en route. The South Kensington Museum, London, contains several fine ivory reliefs by him.

DURA MATER, dū'ra mātėr, the outer envelope or covering of the brain (q.v.).

DURAM, doo-rān', or **DURÃO, José de Santa Rita,** Brazilian poet: b. near Mariana, province of Minas Geraes, 1737; d. Lisbon, Portugal, 1783. He qualified himself for the service of the Church by his studies at Rio Janeiro and at Coimbra in Portugal, was graduated doctor of divinity at the university of the latter city and joined the religious order of Saint Augustine. In the course of his travels in Spain and Italy he became acquainted with Alfieri and other eminent men of letters, and subsequently during his residence at Coimbra composed a poem founded upon the story of the Galician adventurer, Diego Alvarez Correa, surnamed Caramuru, the legendary hero of Bahia. This poem was published at Lisbon in 1781, under the title of 'Caramuru, poema epico do descobrimento da Bahia,' and a French version appeared at Paris in 1829. On its first appearance the poem was not highly estimated, but since then has risen to the rank of a national epic in Brazil.

DURAMEN, dū-rā'mĕn (a Latin word for hardness), the heart-wood or central wood in the trunk of exogenous trees as found in *dicotyledons* and *conifers.* (See CONIFERA). It is hard and dense, and often dark-colored, with its tubes dry and thick. Thus in the ebony the duramen is black and is the part used for furniture and fine cabinet-making. The alburnum (q.v.), or outer wood, is pale. In the beech the heartwood is light brown; in the oak deep brown; in the Judas-tree yellow and in guaiacum greenish. The relative proportion of duramen and alburnum differs in different trees. By ship-carpenters the duramen is known as the «spine.»

DURAN, doo-rān', **Augustin,** Spanish scholar: b. Madrid, 14 Oct. 1789; d. there, 1 Dec. 1862. He was carefully educated in the classics, studied law at Seville, where he also practised. During the first Carlist War he served as secretary for the censorship of the press. In 1854–55 he was director of the National Library. He paid much attention to the study of foreign, especially to French literature, and edited a very important collection of Moorish, miscellaneous and historical ballads, and ballads of chivalry (1828–32), a new edition forming part of the extensive 'Biblioteca de autores Españoles' (Madrid 1849–51). He also wrote a history of the Spanish drama from its origin to the middle of the 18th century.

DURAN, Carolus (CHARLES AUGUSTE EMILE DURAND). See CAROLUS-DURAN.

DURANCE, dū-rāns', a river in France, which rises in Mount Genèvre, on the west slope of the Cottian Alps; flows in a general direction south, and, after a course of about 220 miles, empties into the Rhone, four miles below Avignon. The stream is so full of débris that it is not navigable and often commits great ravages by inundation. Marseilles receives its water supply from the Durance by a viaduct over 50 miles in length.

DURAND, dü-rāñ', **Alice Mary Céleste Fleury** («HENRY GRÉVILLE»), French novelist: b. Paris, 12 Oct. 1842; d. there, 26 May 1902. In early life she went to Petrograd with her father, Professor Fleury. She there married M. Durand, a French law professor, returning to France in 1872. She visited the United States in 1886 and several of her novels, republished in America, had a wide circulation here. Her published works, appearing under the pseudonym, «HENRY GRÉVILLE,» include 'A Travers Champs' (1872); 'Dosia' (1876); 'L'Expiation de Savelli' (1876); 'La Princesse Oghéroff' (1876); 'Les Koumiassine' (1877); 'Suzanne Normis' (1877); 'Sonia' (1877); 'La Maison Maurège' (1877); 'Les Épreuves de Raissa' (1877); 'L'Amie' (1878); 'Un violon russe' (1879); 'Lucie Rodey' (1879); 'Le Moulin Frappier' (1880); 'La cité Ménard' (1880); 'Madame de Dreux' (1881); 'Rose Rozier' (1882); 'Manuel d'Instruction Civique et Morale des Jeunes Filles' (1882); 'Un Crime' (1884); 'Idylles' (1885); 'Cleopatre' (1886); 'Frankley' (1880); 'L'avenir d'Aline' (1889); 'Chant de Noces' (1889); 'Le Passe' (1890); 'Un Mystère' (1890); 'Aurette' (1891); 'Péril' (1891); 'L'Heritière' (1891); 'Un vieux menage' (1893); 'Fidelka' (1894), etc. Consult Ernest-Charles, 'Les samedis littéraires' (Paris 1903).

DURAND, Asher Brown, American painter and engraver: b. South Orange, N. J., 21 Aug. 1796; d. there, 17 Sept. 1886. He was apprenticed to the engraver Maverick, of whom he was afterward partner. For a long time his employment consisted in copying prints from English books and working on plates for bank notes. His engraving of Trumbull's 'Declaration of Independence' brought him into general notice, and thenceforth for many years his graver was in constant demand for portraits of various dimensions and figure pieces. He had always, however, entertained the idea of ultimately becoming a painter and in 1835, having

for the previous 10 years been a regular contributor of portraits, small figure pieces or landscapes in oil to the exhibitions of the National Academy of Design, finally abandoned engraving as a profession. He devoted himself thereafter mainly to landscape painting, in which department of art he became eminent. His subjects included General Jackson, Henry Clay and heads of all the presidents, from nature or copied. With Thomas Cole he founded the American landscape school. His landscapes are large sketches painted directly from nature. His composition was imperfect but his work is interesting in detail. The Corcoran Art Gallery at Washington contains his 'Mountain Forest' (1869), and the Metropolitan Museum, New York, contains four of his works, including 'In the Woods,' one of his best landscapes. The New York Public Library has another fine example. He was one of the original members and president of the National Academy of Design. Consult the biography by John Durand (New York 1894) and Isham 'History of American Painting' (ib. 1907).

DURAND, E(dward) Dana, American statistician: b. Romeo, Mich., 18 Oct. 1871. He was educated at Oberlin College and at Cornell University. He was legislative librarian of the New York State Library in 1895–97; assistant professor of administration and finance, Leland Stanford, Jr., University, in 1898–99; secretary of the United States Industrial Commission in 1900–02, and instructor in economics at Harvard in 1902. He served as special expert agent of the United States Census Office on street-railways and electric-lighting plants in 1902 and special examiner of the Bureau of Corporations 1903–07. In 1907–09 he was a deputy commissioner of corporations and was director of the United States census in 1909–13, since when he has been professor of statistics and agricultural economics at the University of Minnesota. He is author of 'Finances of New York City' (1898); 'The Trust Problem' (1915), and contributions on economics and political subjects to various journals, and reports of the Industrial Commismission, the Census Bureau, etc.

DURAND, William Frederick, American engineer: b. Bethany, Conn., 5 March 1859. He was graduated at Annapolis 1880; served in the United States Naval Engineer Corps (1880–87); was professor of mechanical engineering in the Michigan Agricultural and Mechanical College (1887–91), when he became associate professor of marine engineering at Cornell, and full professor in 1895. He continued his work at Cornell University until 1904 when he became professor of mechanical engineering at Stanford University, which position he now holds. In 1915 he was appointed by President Wilson member of the National Advisory Committee on Aeronautics. He also served as chairman of the committee of management for the International Engineering Congress held in San Francisco in 1915. He has published 'Fundamental Principles of Mechanics' (1889); 'Resistance and Propulsion of Ships' (1898); 'Practical Marine Engineering' (1902); 'Motor Boats' (1907), and many special articles in engineering journals.

DURAND, Wis., city, county-seat of Pepin County; on the Chippewa River, about 20 miles from its junction with the Mississippi, and on the Chicago, Milwaukee and Saint Paul Railroad. It is the centre of an agricultural region, and its trade and industries are those that pertain to agriculture and stock-raising. Pop. 1,503.

DURANDUS, dū-rän'dus, **Gulielmus,** French prelate and jurist: b. Puimisson, Languedoc, 1237; d. Rome, 1 Nov. 1296. He became professor of the canon law in the University of Modena, and there acquired so high a reputation for his learning that Pope Clement IV made him auditor of the Sacred Palace, and took him as his secretary to the General Council of Lyons (1274). In 1277 he was appointed lieutenant-governor of the patrimony of Saint Peter, under Nicholas III; the following year he successfully asserted the sovereignty of the Pope over the provinces of Bologna and Romagna. These two provinces he then governed from 1283 to 1286, in the meantime carrying on a war against the people of Romagna, who were in revolt. He was appointed bishop of Mende in Languedoc in the latter year, and retired from the governorship. In 1295 he was again in public station, governor of Romagna and the March of Ancona; but his strength was unequal to the task of resisting the attacks of the Ghibelline faction, and he resigned his office. His greatest work, 'Speculum Juris' (mirror of the law), called by himself 'Speculum Judiciale,' was for a long time a work of highest authority in Roman and ecclesiastical law; between the years 1474 and 1678 it passed through 38 editions. He wrote an informal history (commentarius) of the General Council of Lyons, the decrees of which were drawn up by him. His 'Rationale Divinorum Officiorum' published at Mainz in 1459, is a standard work on the liturgy of the Roman Church.

DURANGO, dū-răn'gō, Colo., town, county-seat of La Plata County; on the Las Animas River, the Denver and Rio Grande, and the Rio Grande Southern railroads; about 20 miles north of the boundary line between Colorado and New Mexico. There is a Carnegie library. The town is the centre of trade for the surrounding region in Colorado and New Mexico which produces gold, lead and silver and carries on extensive stock raising and agriculture. The principal industries are the smelting and manufacture of the mineral products, flour manufacture, packing, coal and coke mining. Durango has been governed under the commission plan since April 1913. Pop. 5,000.

DURANGO, doo-răn'gō, Mexico, an inland state of the North, bounded by Chihuahua on the north, Coahuila on the northeast, Zacatecas and Tepic on the southeast and south, and Sinaloa on the west. Its area is 38,009 square miles. It is one of the largest and richest states in the republic. The Sierra Madre range (altitude 8,125 feet to 11,375 feet) traverses the western and southern portions. Less important ranges are the Copolquina, Topia, Cavelas, Amacuti, Tominil, Muinora, Guanaccoi and San Juan de Camarones; these, as well as the isolated peaks, Cerro del Mercado, Pánuco de Avino, etc., are ore-bearing. The Cerro del Fraile is an extinct volcano. Among the rivers, the Nazas, in the northern part of the state, with its afflu-

ents, the Santiago and San Juan; the Tunal, which rises west of the city of Durango, and its affluent, the Suchil; the Rio Chico, or Alaponeta and the Aguanaval, may be mentioned. There are small lakes, mineral springs, etc. Gold, copper and silver are the chief mineral products, and the best mining districts are those of San Dimas, Guarisamey, Buenavista, Gavilanes, Guanacévi, Mapimi, El Oro and Indé. In the San Dimas district is the celebrated Candelaria mine, where the ore assays between $70 and $140 a ton. This mine is said to have yielded over $100,000,000 before the close of the 19th century. The Cerro del Mercado, near Durango city, contains an immense deposit of high grade iron ore and is estimated to contain 300,000,000 tons of that metal. Near it are iron and steel works. The mines are controlled chiefly by American capital. Sulphur, copper, iron, cinnabar, tin, coal and rubies are also found. With the exception of silver, the mineral resources of the state have been but slightly developed owing to inadequate and costly transportation facilities. The Mexican Central Railroad crosses the eastern side of the state from north to south, and the Mexican International crosses it from northeast to southwest, running through the capital and connecting it with the port of Mazatlan on the Pacific coast. The climate varies with the altitude of the different localities, being cool or cold in the mountainous western regions, and temperate, or warm, in the valleys extending from the base of the mountains and in the Nazas basin. There is very little rainfall in the eastern part of the state. The climate is generally dry and healthful, but hot on the western slope of the Sierra. The soil of the plateaus is generally of good quality and with irrigation could be made very productive. Cotton is produced to a small extent. Wheat, maize, tobacco, sugar-cane and grapes are also grown in certain districts, and stock-raising is successfully practised in the higher valleys of the Sierras. Since the beginning of the 20th century manufacturing has been making considerable progress. There are several cotton mills in operation, consuming annually about 500,000 kilos, and with an output valued approximately at 600,000 pesos. Soap and candle factories, tanneries, pottery works, etc., are also in operation. Durango originally formed part of the province of Nueva Viscaya. The capital is Durango (pop. 32,263), and among the principal towns are Quanacevi (pop. 6,859), El Oro, Nombre de Dios, San Juan de Guadalupe, San Dimas and Villa Terdo. Pop. 510,000. The inhabitants are largely of Indian blood, are almost entirely Roman Catholics, and about 84 per cent are illiterate.

DURANGO, Mexico. Capital of the State of Durango. It is situated 6,321 feet above sea level, has an average temperature the year round of 70° F. in the shade. Pop. 32,263. Founded in 1563 and decreed a city by Philip IV in 1621. It was long the capital of the province of Nueva Vizcaya and has been an important trade centre since a very early day, of a territory including the Mexican state of Chihuahua and the southern portion of Texas and New Mexico. It is 540 miles from Eagle Pass, on the Texas border, by the International Railway, and 480 miles from Mexico City. It is a city of considerable wealth, the region round about being very rich, both in minerals and agriculture. Many Americans are located here and are actively engaged in enterprises of various kinds, adding materially to the prosperity of the community. Almost within the city's limits rises a wonderful hill of very nearly pure iron, the famous Cerro del Mercado, 640 feet high, 4,800 feet long and 1,100 feet wide, which has been estimated by mining engineers to contain 300,000,000 tons of that metal. Among the local industries are extensive ironworks, cotton and woolen mills, foundries, sugar-cane mills, tobacco factory and flour mills. The stores and shops are particularly well stocked and creditable. A local bank — the Bank of Durango — with a capital of $2,000,000, and a branch of the National Bank and an agency of the Bank of London and Mexico provide for financial needs. The notable buildings are the Cathedral, which was begun in 1695 and completed in 1844; the new City Hospital; the college formerly controlled by the Jesuits, founded in 1594; the Episcopal Seminary; the Methodist Episcopal Church; the Catholic churches of San Francisco, San Juan de Dios and San Agustin; the government palace; the market house and a magnificent theatre. A penitentiary and bull ring are located here also. It formerly had a mint, in which was coined annually about $1,000,000 in gold and silver. An Alameda and several plazas tempt the lover of nature. Not far distant is an everflowing stream which is said to excel the famous one in the grounds of Chapultepec park, at the national capital, and from which the city receives its drinking water. Two electric light companies supply light and there are street railways and telephone service. Durango is called the «Denver of Mexico.»

DURANT, Henry Fowle, American philanthropist: b. Hanover, N. H., 20 Feb. 1822; d. Wellesley, Mass., 3 Oct. 1881. He was graduated from Harvard in 1842 and became a lawyer, changing his name from Henry Welles Smith to H. T. Durant. He practised with great success at the bar, but on the death of his only son abandoned his profession and devoted his energies to philanthropy. From 1864–75 he was a lay preacher in Massachusetts and New Hampshire. He founded Wellesley College (q.v.), opened in 1875.

DURANT, Okla., city and county-seat of Bryan County, situated on the Missouri, Oklahoma and Gulf, the Missouri, Kansas and Texas and the Saint Louis and San Francisco railroads, 20 miles northeast of Denison, Texas. The Southeastern State Normal School and a Presbyterian College are located here. Agriculture is the chief industry and cotton, corn and berries are raised. There are also flour and oil mills. The city owns its electric lighting plant and waterworks. The government is vested in a mayor and a unicameral council of six members, under a charter received in 1904. Pop. 5,330.

DURATION, in plants, the period for which any given part of the plant remains alive. The duration of the plant as a whole is conditioned primarily by that of the roots; an annual lives for only one vegetative period, a biennial for two and a perennial for a number of such periods. The same plant, such as wheat, may

be an annual if planted early and a biennial if planted late. Similarly, plants such as the castor oil bean, which are perennials in an equable climate, are often annuals where there is a winter and vice versa. In ground left to itself the perennials tend to drive out the annuals. In biennials and herbaceous perennials, the part of the plant which survives the winter or dry season is generally underground and the leaves and stalks die away each year and are produced anew.

In shrubs or trees the duration of the stalks may be measured in centuries, or even in millenia. However, the original live wood becomes dead wood after a few years. Leaves are of much shorter duration, ranging from days in the case of cotyledons or some xerophytic leaves to perhaps ten years in the conifers. In deciduous trees the fall of the leaf is due to the formation of a special zone of fracture at the base of the leaf stalk, which gives a scar covered by cork before or after the stalk breaks. In such trees as the oak or beech this zone of fracture is imperfectly formed, so that the dead leaves remain on the trees throughout the winter. The duration of flowers is usually relatively brief and may be limited to a few hours, as is the case with the night-blooming cereus, but there are certain orchids such as odontoglossum which may remain open for almost three months if they are not pollinated. It will be noted that tissues which have a perennial duration are generally woody or otherwise mechanically strengthened and protected, whereas delicate, leafy or herbaceous structures are unable to survive periods of climatic adversity.

DURATION or PERSISTENCE IN TIME, one of the attributes of a sensory experience or an emotional state. It is only with difficulty subject to further analysis, if at all. The flash or snap of a spark seems to carry with its place in the scale, "longer or shorter," as directly as in the quality scale of redder or yellower, higher or lower in pitch, or in the intensity scale of brighter or duller, louder or more quiet. One of the cardinal problems of sensory psychology, then, is the study of the properties of this intrinsic temporal relation between experiences.

In the first place, by a historical development with which we are not here concerned, we have come into the possession of instruments which, through the mediation of what we know as periodic processes, enable us to assign a certain number as a temporal measure to the phenomena which we observe. This number stands in a very close relationship to our experience of duration: in general that datum which we experience as more lasting will have a greater temporal measure. The first task of the investigator of duration is to determine to what extent this rule holds good, and what the exceptions to it are. It is found that the situation here is in most respects parallel to that in other series. There is in each sense an initial limen (see LIMINA) below which a decrease in the temporal measure produces no decrease in the sensory duration. In the case of light, at any rate, although apparently not of sound, unlike the situation in the intensity series this lower limen of duration does not approximately coincide with the total evanescence of all sensation: thus an electrical spark of just noticeable intensity lasting 1/10,000 of a second, though still visible, cannot be distinguished from a spark likewise of just noticeable intensity lasting 1/100,000 of a second. In addition to the initial limen, duration in each sense has a difference limen, or just noticeable difference in duration and there is a terminal stimulus beyond which increases in the temporal measure although they may be correlated with experiences which enable us to place them in our temporal system (see TIME), are no longer registered by increases in the duration of a single sense-datum. The initial stimulus for a tone of 64 vibrations is 1/40 second; of 187 vibrations, 1/125 second; of 3,168 vibrations or over, 0.0063 second. Observations on the initial limen, difference-limen and terminal stimulus for the duration of sense-data are relatively scanty, but these same sorts of quantity exist for temporal intervals and here the literature is much more rich. If the intervals are measured between sharp sounds, the initial limen, which here nearly coincides with the lower limit of observable intervals, is about 1/400 of a second. The difference limen is about 1/100 of the temporal measure of the stimulus when the latter is in the neighborhood of 0.3 second. For moderate stimuli Weber's Law (q.v.) is approximately obeyed. The terminal stimulus is about 0.5 or 0.6 second. The initial limen of visual intervals is about 0.005 second, of tactile (pressure) intervals about 0.0002 second. For intervals between sensations of two kinds, the initial limen, which is between 0.1 and 0.02 second, varies with the order of the stimuli. While it is natural to suppose that the initial limen for sensation differences of a given sort is about the same as for sensations of the sort, it should be noted that this is not an a priori law. Another quantity which is also of much the same size is the length of the liminal experience *qua* experience. This is the measure by the chronometer of the interval from the instant at which the subject is aware of the presence of the stimulus to the instant at which he is aware it is no longer present. For light Külpe has estimated that this period is about 1/20 second.

All the numerical values here are based on measurements which it is difficult, in fact almost impossible, to make with any high degree of accuracy. A rapid succession of like sensations as the speed is increased, does not at once fuse into a single sensation, but goes through the very complicated phases of "flicker" or "rattle" or "vibration," where there seems to be superimposed upon a sequence of experiences a new single experience. Just when the sequence completely disappears is not easy to ascertain. For this reason, estimates as to least noticeable intervals are likely to have a probable error bigger than the measurement itself. (See BERGSON, HENRI; TIME). Consult Külpe, 'Outlines of Psychology' (tr. London 1901); Meumann, in *Philosophische studien* (VIII Leipzig 1893); Stern, 'Psychologie der Veränderungs auffassung' (Breslau 1898); Titchener, 'Experimental Psychology' (II, ii, New York 1905); Weyer, in *Philosophische Studien* (IX, Leipzig 1894); Wundt, 'Grundzüge der Physiologischen Psychologie' (Leipzig 1908–11).

DURAZNO, doo-räs'nō, Uruguay, a department bounded on the north by Tacuarembo,

east and southeast by Cerro Largo and Treinta y Tres, on the south by Florida and Flores, and on the west by Flores and Rio Negro. It is the most central of the departments, and in size the third. Area, 5,527 square miles. A range of hills divides it into two sections or basins, of which one extends northward to the Rio Negro, and the other southward to the Yi River, the department lying between these two rivers. Numerous streams, rising in the central chain of hills, flow toward the south or north; the entire surface is, therefore, well watered, and furnishes grazing for a large number of cattle, sheep, horses and mules. Pop. about 50,000.

DURAZNO or SAN PEDRO DEL DURAZNO, Uruguay, capital of the department of Durazno. It is situated near the Yi River and is one of the principal stations on the Central Uruguay Railroad. As an active centre for the trading of the neighborhood, it has substantial buildings, a church, hotels and shops. Pop. about 11,000.

DURAZZO, doo-rät'sō (ancient DYRRHACHIUM or EPIDAMNUS), Turkey, a seaport in the principality of Albania, on the Adriatic, 50 miles south by west of Scutari. A Catholic archbishopric has been located here since the time of Justinian. The chief exports are raw silk, wool, oil and grain. It was originally founded by a colony of Greeks from Corcyra, in the 7th century B.C., and was long under the name of Epidamnus, the most important maritime town of Illyria. In the early part of the 3d century it fell into the hands of the Romans who changed the name of the city to Dyrrhachium. Cæsar besieged the armies of Pompey here. The Byzantines gained possession of it at the end of the 4th century, and made it the capital of New Epirus. The Ostrogoths, Bulgarians, Normans, the house of Anjou and Venice owned it successively. It was finally taken by the Turks in 1501, who made it a part of the Vilayet of Scutari. In the Balkan War (1912–13) it was an important strategic point because the Servians desired it as an outlet for their commerce on the Adriatic. The final treaty left it in the hands of the new principality of Albania under the government of William of Wied. At the outbreak of the European War, toward the end of July 1914, the prince and the international commission left the province and a state of anarchy followed. Essad Pasha Topdani, the recently expelled Turkish ruler, attempted to establish a military government at Durazzo, but the effort ended in failure (5 Oct. 1914). The Austrians finally overran the country capturing Durazzo on 28 Feb. 1916. A few columns and marble are now almost the only remains of the ancient city. The modern town is a poor place of about 5,000.

DURBAN, dėr'băn, or **PORT NATAL,** town, the only seaport of Natal; situated on the northern shore of the land-locked inlet known as Bay of Natal, the south end of which is marked by the fortified bluff and its lighthouse. It is the only city of Natal, and the fourth seaport in importance in British South Africa. Durban has become known as a watering place, and has electric street railways and all modern sanitary conveniences, including public baths. The centre of the town is occupied by fine public gardens; there are also botanical gardens, a museum, an art gallery, a public library, a theatre, two parks and a racecourse. In 1910 a new group of municipal buildings was completed at a cost of more than $1,500,000. Water is brought from a river 15 miles distant. The climate, although exceedingly hot during one or two months, is the most healthful of all African towns. The harbor, greatly improved by extensive wharves and dredging, is well protected and is sufficiently deep for vessels of 30-foot draft. The exports of the port in 1915 totaled $17,567,525 and the imports amounted to $23,811,955. Besides having a good harbor, Durban derives much importance from its position as the terminus of two railway lines leading into the Orange Free State and Transvaal provinces. The population of the borough on 7 May 1911 was 69,187, consisting of 31,783 European, 17,784 natives and 19,620 Indians and Asiatics. The city was founded by the Dutch in 1828, and received its name Durban from Sir James D'Urban, then governor of Cape Colony.

DUBAR, dėr'băr (Hind. and Pers., *darbar*, door of admittance), in India, Afghanistan and Persia, a state audience at which important public hearings are given, decrees or decisions announced, distinguished foreign visitors received, and treaties, etc., made. These functions are often of great splendor and under British rule there have been several famous durbars in India. The first after the downfall of the Mogul empire and the Mutiny was held 1 Nov. 1858 at Allahabad. Lord Canning then announced the sovereignty of Queen Victoria, and offered amnesty to all but actual murderers of the English. Each viceroy since has held them to impress the Hindus. One of the most magnificent was held by Lord Lytton in 1877, when Queen Victoria took the title of empress of India. The then Prince of Wales had just been visiting India, and been received with enthusiastic demonstrations, and the viceroy summoned the feudatory rulers and their retinues to a great durbar at Delhi, where the proclamation of the new title was made, and festivities, including a grand ball, games, parades, fireworks, convocation of the Indian orders, etc., were held. Another of great splendor was given at the same city on 1 Jan. 1903, to proclaim the accession of Edward VII. The growing native unrest led King George V and his consort to visit India for their Imperial coronation. The most brilliant durbar in modern times was held at Delhi on 12 Dec. 1911 in connection with the coronation ceremonies. Unexpected changes were announced for the administration of India, involving the transference of the capital from Calcutta to Delhi. The name "durbar" is used also for the audience chamber, as we speak of a church (building).

DÜREN (ancient MARCODURUM), Germany, town in Rhenish Prussia, on the Roer and the railroad from Aix-la-Chapelle to Cologne, 18 miles east by north of Aix-la-Chapelle. It is of Roman origin, and is mentioned under its ancient name by Tacitus. In 1543 it was destroyed by the Emperor Charles V, at the head of 50,000 men. Diets were held here by Charlemagne (775 and 779). The chief points of interest are the Gothic church of Saint Anna, containing numerous relics of the saint, which

are visited yearly by numerous pilgrims; the museum containing antiquarian and historical exhibits, and a fine public library. The principal manufactures are paper, sugar, linen, cotton goods, machinery and beer. Pop. 32,511. Consult Schoop, 'Geschichte der Stadt Düren bis 1544' (Düren 1901), and 'Beschreibung des Begreviers Düren' (Bonn 1902).

DÜRER, Albrecht, German painter and engraver: b. Nuremberg, Bavaria, 21 May 1471; d. there, 6 April 1528. His father, Albrecht Dürer, came to Nuremberg in 1455 at the age of 28. He was a goldsmith by trade, and it was not long before he found employment with a well-known burgher of the city and master goldsmith, named Hieronymous Holper. In his 40th year, Dürer, who had won the esteem of his master both because of his fine character and diligent devotion to his duties, married Holper's daughter Barbara, then 15 years of age. He became a citizen of Nuremberg, a master goldsmith in 1468, and moved to a back apartment in the house of Johanna Pirkheimer, a patron of arts and letters, who was an enthusiastic lover of classical learning. Here the artist Albrecht Dürer was born, the second son and third child of the Dürer family. After the death of Holper, the elder Dürer acquired the property on the street called Unter der Vesten, since renamed Burgstrasse. Thither the family moved in 1475 and here a great part of the painter's life was spent. Eighteen children were born to the elder Albrecht, of whom two survived the painter. The others died before reaching any grown-up age. It was difficult work to support his numerous progeny. The younger Dürer speaks with the greatest admiration and affection of his parents who were marked by their piety, simplicity and earnestness of purpose which earned them the well-deserved esteem of their fellow-citizens. After attending school where he learned to read and write and understand a little of Latin, Albert, who was his father's favorite, worked with him in the goldsmith shop and learned that trade. But he soon manifested, at a very early age, a natural predilection for drawing and painting. A likeness of himself drawn with the use of a mirror at the age of 13 is remarkable for its charming clarity of outline and its expressiveness. A year later, he made another drawing, of the 'Virgin and the Child,' which, in spite of defects of drawing, shows fine emotional promise in its tenderness and gracefulness. Accordingly, in 1486, the clever boy was apprenticed to the painter Michael Wohlgemuth for three years.

Painting and drawing in Germany at this period, especially at Nuremberg, were very popular and distinguished crafts. Under the patronage of the burgher and peasant classes, the wood-cut and copper engraving began to turn toward the life and customs of the people for its inspiration. Pictures were used in books as a means of instructing the illiterate. Religious paintings donated to the Church by the wealthy citizens made room on their canvasses for their donors in contemplative attitudes. Portrait and genre painting found its sources here. The artist was esteemed as a very clever artisan who wielded his tools for the benefit and glory of the people about him, rather than as a soul aloof, superior and apart from the life of the time, painting or drawing under the patronage of lords and high church. Each master artist had his apprentices and journeymen, as did other artisans; and they assisted him in cutting his drawings, securing orders and selling prints. It was in this wholesome environment that Dürer worked. In 1490, his apprenticeship being over, he began his Wanderjahre. He went through Germany, stopping at the various studios, plying his trade and filling his sketch-book with studies of people, pictures and landscapes. At Colmar, he probably came into contact with Schongauer; and he studied also, it is said, at Basel and Strassburg. Late in 1493 or early in 1494, Dürer arrived at Venice, at a time when the reawakening of the classical spirit was combining with modern theories of exact proportion to developing original forms of art in the work of Mantegna, the two Bellinis and Jacopo de Barbari. In 1494, his journeys ended and he returned home. He then married Agnes Frey, the daughter of a wealthy burgher, Hans Frey, a very versatile and brilliant man. The pictures of Dürer's wife represent her as a modest, comely housewife. In spite of Pirkheimer's irascible testimony as to the sharpness of her tongue, and the shrewishness of her disposition, there is every reason to believe that the marriage was happy after the fashion of the quiet uneventful domestic life of the city. Dürer moved with his wife to the home of his aged parents and settled there as a master artist, busy with the pressing task of supporting both himself and his parents.

The products of this period (from the establishment of his studio to 1505) are numerous, although there is some confusion as to the authenticity of a large number of engravings and lesser paintings attributed to him. The doubtful ones cannot be mentioned here.

The example of Wohlgemuth is clearly seen in his earlier works, together with some distinct traces of the influence of Mantegna and a conscious striving for the better grasp of perspective and human proportions gained from Jacopo de' Barbari, an Italian painter practising at Nuremberg after 1500. The large works of this period (prior to his second visit to Venice in 1505) are mainly altar-pieces. A comparison of some of the rough drafts with the final canvas show distinctly that the design and the main figures are probably the only parts which can be rightfully assigned to Dürer. The mass of detail was doubtless executed by the various members of his studio. The Dresden altar-piece, depicting the Virgin in the centre, with Saint Sebastian and Saint Antony on either side, shows extreme care in execution and is homely and naïve in its simple representation of the life of the holy family. The Saint Viet altar-piece is inferior in perspective and weaker in color effects. It is a crowded representation of the descent from the cross, too naturalistic in its suffering and inharmonious. The Holzschuler 'Descent from the Cross' in the Moritskappelle in Nuremberg gains in dignity and simplicity. The best of this group of studio paintings is the Paumgärtner altar-piece from the church of Saint Catherine in Nuremberg (now at the Pinakothek in Munich) depicting the nativity of Christ. In the wings are the figures of

knights in full armor, who are evidently the donors, representing Saints George and Eustachius. To this period of his art belongs also 'The Adoration of the Magi' (Uffizi Gallery). It shows decided improvement in perspective, composition and dignity. The colors are fresh and harmonious; the outlines delicate and clear. But it is in the portraits of this period that Dürer hints at the realistic direction which his later works were to take. Most striking are the two of himself. One, painted in 1498 (now at Madrid), shows a young man attired in the gay garb of the lavish fashion of the time. Long fair hair frames a gentle, refined and sensitive face. The other, dated 1500 (Munich), depicts a more mature face with luxuriant beard and hair and direct, fixed eyes. Dignity and great sensitiveness are combined in the calm expression. Two portraits of his father, one in the Uffizi (1490) and the other at the National Gallery, London (1497), show but a passing resemblance to the artist. The sense of increased age is carried in the second by a realistic use of shade and in the now listless hands — which in the first portrait are strong and vigorous. Other portraits are those of Frederick the Wise of Saxony (Berlin); of the 'Fürlegerin,' a lovely young girl with masses of rich golden hair (Royal Gallery at Augsburg), of which two copies of disputed authenticity exist at Munich and Frankfort; Oswald Krell (1499, Pinakothek at Munich); and the Imperial Councillor, Sextus Oelhafen (1503), copies of which are in the Derschau collection and in the library of the university at Würzburg. Another unique painting of the year 1500 is 'Hercules Battling with the Stymphalian Birds' in the Germanic Museum at Nuremberg. It is highly important as an indication of the struggle awakening in the artist as he began to be conscious of the wealth of material in theme and convention which was being rediscovered with the renaissance of classical study.

Dürer's first experiments in wood-cuts were copied after Wohlgemuth. After a few preliminary pieces, there appeared his 16 illustrations for the 'Apocalypse' (1498), a German and Latin edition. The series is full of action, vivid in imagination and composition; intensely realistic, even where incorrect in drawing. The whole is permeated by the awakening religious fervor of Germany — the intense desire to invigorate Christianity once more; and is brimming with joyous youthful faith in the possibility of accomplishing that result. In the clarity of the prints, the artistic handling of light and shade and the subtle rendering of texture, Dürer sets a new standard for the engravers' art. Others of his cuts, though of a little later date, are seven of the series of the 'Great Passion'; part of 'The Holy Family' and part of the 'Life of the Virgin.'

In his copper engravings, Dürer likewise shows the effect of various influences at work in his desire for self-expression by means of the conventions he had acquired both at Nuremberg and in Italy. The careful study of human proportions is the key to the copper plates of this period. Of special note are some early Madonnas, 'Saint Sebastian,' the 'Old Man's Dream,' 'Saint Eustace,' 'Nemesis,' 'Adam and Eve,' 'The Great Horse' and 'The Little Horse.' There are also a few mythological themes — wood-cuts for classical books and for the private possession of the group of humanists who began to carry Italy's past treasures into Germany. From men, such as the old Dr. Hartmann, Schedel, Konrad Celtes and Willibald Pirkheimer, Dürer must have received constant stimulation and encouragement. With the last-named classicist, the artist formed a deep and lasting friendship, the influence of which cannot be overvalued.

Dürer made his second journey to Venice in 1505, to remain for nearly two years. There has been much dispute as to the cause of this journey, but sufficient proof has been brought forward to invalidate Vasari's assumption that the motive was the protection of an abused copyright on his wood-cuts. The most probable reasons were his desire to escape a plague at Nuremberg, to find a market for his works and to execute an altar-piece for the church of Saint Bartholomew at the order of a German colony at Venice. For the fulfilment of this, Dürer painted his 'Feast of the Rose Garlands' (Prague). The Pope and the emperor are represented kneeling before the Virgin and Child, a crowd of saints kneel in the background, where the artist and donor are also depicted, while cherubs bearing garlands of roses float above. In Venice, Dürer met the elder Bellini for whom he had the warmest praise. Other large religious pieces painted during his Venetian visit are 'The Virgin and Child with the Goldfinch' (Berlin); and 'Christ Disputing with the Doctors,' an unsatisfactory and hasty work. The best products of those eventful months are several smaller portraits of Italian types. From the letters to Pirkheimer, we receive an accurate account of the busy and, on the whole, happy time Dürer spent in Italy. His health profited by the milder climate; and the admiring courtesy of the Italians afforded him great satisfaction. He had intended to visit Mantegna at Mantua, but the old master died before his pupil accomplished this pilgrimage, and Dürer returned in 1507 to Nuremberg.

The years from 1507–20 in his native town were filled with high honors and praise. His fame became widespread all over Europe and all the great men of the world sought his acquaintance. His paintings showed increased breadth of treatment, more delicate shading and coloring. 'Adam and Eve' is a triumph in the study of the nude. The original diptych is now in the Pitti Gallery at Florence. The copies at Madrid and Mayence also lay claim to authenticity. In 1508 he painted 'The Massacre of the Ten Thousand Saints' (in the reign of Sapor II of Persia) which hangs now in the Imperial Gallery at Vienna. It was painted at the order of the Elector Frederick of Saxony. The ghastly subject is depicted with great truthfulness in anatomy against a lovely landscape background. The 'Virgin with the Iris' is evidently a school picture, since the work is not uniform. It is on the whole inferior to the 'Assumption of the Virgin,' a triptych painted for Jacob Heller of Frankfort. This picture occupied the artist for a long time — he spent special pains to reinforce the colors and to execute the details with

all possible refinement and skill. It was hung in the church of the Dominicans at Frankfort, but was eventually bought by Maximilian of Bavaria in 1615 and destroyed by fire in 1674. The Dominicans had replaced it by a copy which was faithfully and carefully rendered; and from this, together with numerous studies left by the artist, we are able to form an estimate of the great value of this work. There is no doubt that the best effort of his varied training combined here to produce an effect at once realistic, delicate and spiritual. In the foreground the Apostles are gathered about the tomb of the Virgin. A broad landscape carries the eye into the distance, while above, the Virgin appears between Christ and God who lift the crown above her bent head. Gay little cherubs with variously colored wings surround them. Of great originality and precision is the religious painting of 1511, 'Adoration of the Trinity' now in the Imperial Gallery at Vienna.

In wood-cuts, Dürer now completed his series of the 'Great Passion' and 'The Life of the Virgin.' The later ones are superior in design and in breadth of handling. The 'Mass of Saint Gregory,' the 'Saint Christopher,' the 'Holy Family' are single cuts of this period. The 'Little Passion' in 37 wood-cuts appeared in 1511 and was executed likewise in copper in the succeeding year. Infinite variety of conception and splendid imagination mark these works.

In copper engraving, his three greatest masterpieces were achieved: 'The Knight' (1513); 'Melancolia' and 'Saint Jerome in his Study' (1514). Dürer reaches heights in vigorous handling of the bodies and the depth of emotional expression and the carefully studied light effects. About this time also, Dürer began his experiments in dry-point and acid etching and produced several notable studies. Under the patronage of the Emperor Maximilian he executed in wood 'The Triumphal Procession,' 'The Triumphal Arch,' in which work he doubtless employed many helpers. The pen sketches in the emperor's prayer-book are preserved at Munich and Besançon. A portrait of Maximilian is also one of his finest works. Several smaller copper engravings conclude the work of the artist until the death of his greatest patron and friend in 1519.

In 1520, Dürer journeyed with his wife to the Netherlands, in order to gain further patronage. A journal of his travels supplies us with information concerning the various events. He visited Erasmus at Antwerp and throughout his travels was received with honor and acclaim. After attending the coronation of Charles V at Aachen, his journey led him to Nijmwegen, Brussels, Ghent and Zealand. Dürer filled his sketch-book with studies of the things he had seen and notes of ideas for new works. In 1521 we find him back in Nuremberg much enfeebled in health. Religious themes seem to have occupied him mainly in this last period. Numerous studies and sketches are preserved, showing his plans for new groups. These include drawings of the Virgin, a 'Crucifixion,' the 'Apostles' (1523), Pinatothek, Munich), all admirable studies in expression and temperament, which he presented to the Council of Nuremberg in 1526 and was later sent to Maximilian of Bavaria (1627). 'The Adoration of the Magi' is also a fine pen-drawing, wonderfully simple, realistic and expressive. Copper-engraved portraits of Hieronymous Holzschuler, Pirkheimer, Melanchthon, Erasmus, Frederick the Wise and the Cardinal of Mainz are the best of his line engravings of his last years. Smaller wood-cuts also survive — coats-of-arms, book illustrations, etc., for his friends. Dürer was sympathetic with the Reformation and a warm admirer of its leaders, especially of Melanchthon, but he remained aloof from the stirring controversies of the times and probably adhered to the Wittenberg confession of faith until his death.

Dürer busied himself also in this period with theoretical works on art, two of which were published during his lifetime, one on geometry and perspective (1525); and one on fortification (1527). A work on human proportions appeared posthumously. For a long time the artist had been suffering from an intermittent fever, which began to sap his strength as early as 1507. He is represented in a drawing indicating the source of his disease with his hand. The features are considerably wasted and wan and show the effect of great suffering. Dürer died suddenly. Pirkheimer writes with great bitterness of the fact that his dear friend passed away without a final farewell. He was buried at Nuremberg in the vault of his wife's family in Saint John's cemetery.

The development of Dürer's style is interesting to trace. Throughout his work there is apparent the constant struggle of the artist to free himself from the stiff formal conventions of the old school; to enrich his art by conscious striving for perfection of perspective and proportion. Continuous study of old and new forms, conscientious self-criticism and friendly intercourse with brilliant minds developed that power for intellectual and artistic realism which characterizes those works on which his claim to renown is justly based.

The drawings of Dürer may be studied best at the Albertina Museum, Vienna. Good collections are to be found also at the Berlin Museum and the British Museum. The rest are scattered through the museums of Germany; some are in the collections at Basel, Dresden, Florence, Milan and Oxford; numbers are in private collections.

Bibliography.— Dürer's letters and diaries were partly published by Von Murr in 'Journal zur Kunstgeschichte' (Nuremberg 1785–87); by Campe (ib. 1827); Thausing (1872); and fully in Lange and Fuhse's 'Dürer's schriftliche Nachlass' (Halle 1893). There is a great fund of separate works on the artist, of which there is a careful bibliography by Singer, H. W., 'Versuch einer Dürer — Bibliographie' (Strassburg 1903). The best are by Bartsch, 'Le Peintre-Graveur' (Vol. VII, Vienna 1808); Thausing (2 vols., Leipzig 1884, English translation by Eaton), a scholarly work; Wölfflin, 'Die Kunst Albrecht Dürer's' (Berlin 1907). His prints have been published in 'The Publications of the Dürer Society' (1898–1908); his drawings in the Albertina by Schönbrunner and Hader (Vienna 1895 et seq.); Colvin, in 'Ninety-Three Drawings of

Albrecht Dürer' (London 1898). His engravings have been published by Galichon (Paris 1846–61); Duplessis (ib. 1877); Copper-engravings by Lübke (Nuremberg 1876) and Leitschub (ib. 1900).

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DURESS, dū'rĕs or dū-rĕs' (Ital. *durezza,* Lat. *duritia,* deriv. of *durus,* hard), restraint of liberty, fear of personal injury, or restraint of the person or goods. In its widest sense duress is now said to include all instances where a condition of mind of a person caused by fear of personal injury or loss of limb or injury to such person's wife, child or husband is produced by the wrongful conduct of another, rendering such person incompetent to contract with the exercise of his free-will power. (1) Duress of persons. This is exercised either by incarceration or by unlawful threats or menaces, *duress per minas;* in either case the overt act must consist in compelling an unwilling person to do some act, as to execute a deed or commit an offense; in such cases the act is invalid and excusable. In a broader sense, duress is charged by the law when a person in extreme poverty or distress is induced to seek alleviation by assuming an obligation. Yet the deed signed or the contract made under duress is not void, though voidable at the will of the party compelled to execute or assume it. (2) Duress of goods refers to the case of one who is compelled to pay money for the release of goods unlawfuly detained. Duress may be charged to the collector of a port who charges unauthorized duties.

DURET, dü-rā', **Francisque,** French sculptor: b. Paris, 19 Oct. 1804; d. there, 25 May 1865. He studied sculpture in Paris; in 1823 he won the Roman prize, and gained a gold medal in 1831 by his 'Mercury, Inventor of the Lyre,' which recalled somewhat the refined modernity of Canova. Indeed, Canova seems to have been rather the source of inspiration to him than the models of the antique. In 1833 he produced 'The Neapolitan Fisher Dancing the Tarantula,' a work of life-like realism, of perfect elegance and the most refined modeling, which is his masterpiece and stands in the Louvre. In the same gallery is his 'Improvisatore Singing a Love-Song' (1836), a replica of which is in the city museum of Leipzig. For the museum at Versailles he executed statues of Molière, Dunois and Richelieu; for the Madeleine figures of Christ and Saint Gabriel. The gallery of seven chimneys in the Louvre is adorned by his 'Victory,' and for the foyer of the Théâtre Française he executed statues of 'Tragedy' and 'Comedy' and a figure of Rachel, the actress. In 1860 he completed the monumental fountain on the Place de Saint Michel in Paris. It is surmounted by a figure of 'St. Michael the Dragon-Slayer.' As professor in the Écoles des Beaux Arts, his energies were concentrated on the task of teaching and he produced few original works; those which he has left are good examples of modern French sculpture with its ease, its demonstrative fluidity and dramatic point, which take the place of the serenity and severe but flawless grace of the Greek masters. He was elected a member of the Institute in 1845.

DURFEE, Thomas, American jurist: b. Tiverton, R. I., 6 Feb. 1826; d. Providence, R. I., 6 June 1901. He was graduated at Brown University 1846; was admitted to the bar 1848; reporter of the Rhode Island Supreme Court 1849–53; presiding judge of the Court of Magistrates 1855–60; speaker of the Rhode Island house of representatives 1863–65; associate justice of the Rhode Island Supreme Court 1865–75, and chief justice 1875–91, when he retired. He was elected a trustee of Brown University 1875, and its chancellor 1879–88. He published 'Reports of Cases in the Supreme Court of Rhode Island' (1851–53); 'Treatise on the Law of Highways' (1857), begun by J. K. Angell; 'The Village Picnic and Other Poems' (1872); 'Gleanings from the Judicial History of Rhode Island' (1883); 'Some Thoughts on the Constitution of Rhode Island' (1884), and several orations on public occasions.

D'URFEY, dĕr'fĭ, **Thomas,** commonly known as "TOM D'URFEY," English dramatist and poet: b. Exeter, 1653; d. London, 26 Feb. 1723. He was a good-natured, simple-hearted, thoroughly vulgar and unliterary writer. His dramas, comedies, operas, tragedies and songs are like what Sancho Panza would have written if he had taken to letters. Many, like 'The Siege of Memphis' (1676), a tragedy, and 'The Plotting Sisters' (1691), a comedy, are verbose; others, like the 'Songs Complete' (1699), are of virginal simplicity, but not of virginal modesty.

DURGA, door'gā, or **PARVATI** (Sanskrit, "The Inaccessible One"), a Hindu divinity, one of the names given to the consort of Siva when she appears to inspire fear. She is generally represented with 10 arms. In one hand she holds a spear, with which she is piercing Mahisha, the chief of the demons, the killing of whom was her most famous exploit; in another a sword; in a third the hair of the demon chief; and in others the trident, discus, axe, club and shield. A great festival in her honor, the *Durgapuja,* is celebrated annually in Bengal with wild orgies about the beginning of October and lasts for about 10 days in all. See SIVA, DEVI.

DURGAH, The, a famous tomb built for the Sheikh Selim-Chisti, at Futtehpore, near Agra, in Hindustan. It was erected at a cost of 37 lacs of rupes, or $1,750,000. The tomb, as well as a canopy six feet high which covers it, is made of mother-of-pearl. The floor is of jasper and the walls of white marble inlaid with cornelian. The screens of marble surrounding the building are the most beautiful in India. They are single, thin slabs about eight feet square and wrought into such intricate open patterns that they appear as having been woven in a loom.

DURHAM, John George Lambton, 1st EARL OF, British statesman: b. London, 12 April 1792; d. Cowes, Isle of Wight, 28 July 1840. He was educated at Eton, and was returned to the House of Commons as Liberal member for Durham in 1813. An ardent reformer, he was known as "Radical Jack," favored in 1819 shorter Parliaments, was a supporter of Queen Caroline, and refused to accept a qualified Catholic emancipation. In 1828 he was created Baron Durham, and in 1833 Viscount Lambton and Earl of Durham. He held the office of Lord Privy Seal in the Cabinet of Lord Grey

(1830), his father-in-law, and took a leading part in framing the Reform Bill of 1832 and urged the creation of peers as a coercive measure in the event of the House of Lords proving recalcitrant. In 1832 he was Ambassador Extraordinary to the courts of Vienna, Berlin and Saint Petersburg and Ambassador Extraordinary and Plenipotentiary at Saint Petersburg, 1835–37.

Durham was appointed on 30 March 1838 governor-in-chief of all the Canadian provinces and high commissioner in Lower and Upper Canada, and this post he held till 1 November in that year. The situation he had to meet on his arrival on 27 May was grave and menacing. The rebellions had been crushed, but in both provinces there was intense irritation against the authorities, and there was threatened trouble on the international border, which was abetted by the state governments. Durham succeeded in securing the co-operation of the Washington government in maintaining peace. He passed an ordinance on 28 June banishing to Bermuda certain of the prisoners taken in the Lower Canada Rebellion of 1837; but this measure was assailed in the British Parliament as beyond the powers of Durham's commission; the Prime Minister, Lord Melbourne, offered only a half-hearted defense, and in the end the ordinance was disallowed. Durham felt he had been betrayed by the ministers who had appointed him, and at once resigned, issuing at the same time a proclamation vindicating his conduct. On his return he busied himself with the preparation of his 'Report on the Affairs of British North America,' perhaps the most important state paper ever issued on the principles of colonial government. For the evils that existed in the Canadas he proposed the introduction of responsible government by the creation of an executive dependent on the majority in the elective assembly, the union of the Canadas, municipal government, state-aided immigration, the repeal of the laws on the clergy reserves and formation of an inter-colonial railway. Durham's policy in the extension of colonial self-government came to fruition under the administration of his son-in-law, Lord Elgin, and has since been applied to all the British overseas dominions. In 1839 Durham became chairman of the New Zealand Colonization Company and thus had a part in the early settlement of that British colony. Consult the 'Life and Letters of Lord Durham,' edited by Reid.

DURHAM, one of the three English counties called counties palatine. Area, 649,244 acres. The soil is productive and good crops of wheat, oats, potatoes and turnips are raised. There is more coal mined in Durham than in any other county of England, and lead and iron mines are worked. Some of its manufactories are ironworks, potteries, linen- and woolen-mills, glass and chemical works. Shipbuilding is an important industry. For parliamentary purposes the county is divided into eight divisions. Pop. 1,369,860.

DURHAM (ancient DUNHOLME), England, city and parliamentary borough, capital of the county of the same name, on the river Wear, 14 miles south of Newcastle. It is celebrated for its noble cathedral, which stands in a fine situation on wooded banks of the river, the site of which was chosen as the resting-place of the body of Saint Cuthbert by the monks of Lindisfarne, driven from Holy Island by Danish marauders, and who built a chapel here to receive the body. The present building dates from 1093, with additions in all the styles down to the middle of the 16th century. It is 496 feet long, the greatest height within the building is 84 feet and the central tower is 218 feet high. The venerable Bede is buried within its precincts. The castle was founded by William the Conqueror in 1072. The University of Durham was founded by Oliver Cromwell in 1646, suppressed at the Restoration and reconstituted in 1833. The battle of Neville's Cross was fought close by, in 1346, resulting in the defeat of the invading Scots. Four miles west is the Roman Catholic College of Saint Cuthbert, Ushaw, founded after the religious orders were driven from Douay during the French Revolution. The city is the seat of an Anglican bishropric and returns a member to Parliament. Pop. 17,550. Consult Leighton, 'Memorials of Old Durham' (1910); Kitchin, 'Story of the Deanery' (1912).

DURHAM, N. C., city in Durham County, on the Southern Air Line and the Southern railroads; 26 miles northwest of Raleigh. It is a tobacco and cotton-growing centre, and the seat of Trinity College (Methodist Episcopal South). The city has also a school of fine art and a conservatory of music, a public library and Watts Hospital. The government is administered under a charter of 1899 which provides for a mayor, chosen every two years, and a city council, elected on a general ticket. Settled about 1855, Durham was incorporated in 1869 with a population of 200. The manufacture of a famous brand of smoking tobacco is the staple industry of the place. There are also cotton mills, sash and blind factories, foundries, a fertilizer factory and other industries. The United States census of manufacturers for 1914 showed within the city limits 62 industrial establishments of factory grade, employing 5,453 persons; 4,764 being wage-earners, receiving annually a total of $1,501,000 in wages. The capital invested aggregated $17,752,000, and the year's output was valued at $27,597,000; of this, $15,094,000 was the value added by manufacture. It was the scene of the treaty between Generals Sherman and Johnston at the close of the Civil War. It has a national bank, newspapers and good schools. Pop. 22,863.

DURHAM, University of, located at Durham and which was originated in 1831 under Bishop Van Mildert by the appropriation of part of the property belonging to the cathedral chapter. In 1832 an act of Parliament was obtained sanctioning the erection of the proposed university; in 1833 the university was opened and in 1837 it was incorporated by royal charter. In 1841 the office of warden was permanently annexed to the deanery of Durham, a canonry in the cathedral was annexed to each of the professors of divinity and Greek, a professor of mathematics and astronomy appointed and fellowships founded. As at Oxford and Cambridge the students reside mostly within the university buildings, accommodation being provided for them in University College and in Bishop Hatfield's Hall. The university awards the degrees of Bachelor and Master of Arts, Bachelor and Doctor of Literature, of Science

and of Divinity, the usual medical degrees, degrees in music and the degree of Doctor of Civil Law. The academical year is divided into three terms — Michaelmas, Epiphany and Easter. No religious test is required from any member of the university unless he is a student in the faculty of theology. Science was taught from the first, but not to a satisfactory extent till 1871, when the Durham College of Science was instituted in connection with the university at Newcastle-upon-Tyne, the name of which was changed in 1904 to Armstrong College. The medical department of the university is constituted by the Durham University College of Medicine, founded in 1851 at Newcastle, an institution which has greatly increased in efficiency in recent years by the establishment of additional chairs. Since 1895 all degrees except those in divinity may be granted to women. There are over 37,000 volumes in the library.

DURHAM BOOK, The, or **SAINT CUTHBERT'S BOOK,** a manuscript of the Latin text of the gospels, with an interlinear gloss in Saxon. The book dates from the last of the 7th century and is supposed by some to have been written by Eadfrith, of Lindisfarne. It is one of the most beautiful of the manuscripts made by the old monks, and is one of the most highly prized treasures of the British Museum.

DURHAM CATTLE. See CATTLE.

DURIAN, dū'ri-ạn (*Durio zibethinus*), a fruit tree of the family *Bombacaceæ,* generally diffused over the southeast of Asia, especially in the Malay Peninsula and neighboring islands. It is esteemed for the flavor of its fruit, which, however, is an acquired taste, the fruit having a strong, offensive odor and a somewhat terebinthine flavor. The tree, which on an average yields 200 fruits annually, is about the size and the form of a pear tree, but with cherry-shaped leaves, except that they are entire and smooth at the edges. The flowers are large and of a yellowish-white. The fruit, of globular or oval form, from 8 to 10 inches long, large in some species as a man's head, is not unlike the bread-fruit externally. It has a hard prickly rind, covered with warts and tubercles. When ripe it becomes of a brownish-yellow and opens at the top; it must be eaten almost fresh from the tree, as it putrefies in less than 24 hours. The fruit contains five large longitudinal cells, each containing one to four seeds about the size of pigeon's eggs embedded in a custard-like pulp, which is the delicious part of the fruit. The seeds are roasted and eaten like chestnuts, ground into flour and also used as vegetable ivory. The pharmaceutical qualities of the fruit are aphrodisiacal.

DURIRON, a trade name for an iron-silicon alloy, containing about 14 per cent of silicon. The alloy is extremely hard and close-grained, of a gray color and white fracture, and is highly resistant to erosion and corrosion. It has a specific gravity of 7.00 and weighs 437 pounds per cubic foot. Its tensile strength is 10,000 to 12,000 pounds per square inch and its compression strength 70,000 pounds per square inch. Its electrical conductivity is one-fortieth of that of copper. It melts at about 2,500° F. and is very fluid in the molten state, permitting casting in very thin sections. The metal is so hard that it cannot be machined, but is finished by grinding. Duriron is not affected or but very slightly by 25 per cent sulphuric acid or 25 per cent nitric acid, sulphate of aluminum, hypochlorites of lime and soda, tannic and gallic acids, pyroligneous acid, caustic soda, copper sulphate, hydrofluo-silicic acid, tartaric acid and ammonium chloride. It is used for kettles, pumps, pipes, valves and fittings for use in acid and alkali manufacture.

DURKHEIM, dürk'hīm, **Emile,** French writer on sociology: b. Epinal (in the Vosges), 15 April 1858. He was professor of philology at the Sens Lycée, the Saint Quintin Lycée and the Troyes Lycée (1882–87), professor of sociology at Bordeaux (1887–1902), since which time he has been in the University of Paris, where he is at present professor of the Faculty of Letters. He is a knight of the Legion of Honor and a member of the committee on historical works. Among his numerous published works are 'La Division du travail social' (1893); 'Les Règles de la méthode sociologique' (1897); 'L'Année sociologique' (1898); 'Le Suicide, étude de sociologie' (1897).

DÜRKHEIM, dürk'hīm, or **DÜRKHEIM AN DER HARDT,** Bavaria, town in the Palatinate, 14 miles southwest of Mannheim. Its annual sausage market, founded in 1494, is attended by large numbers of people. Dürkheim has saline springs, in the water of which Bunsen and Kirchhoff by spectrum analysis first detected the metals rubidium and cæsium in 1860. Dürkheim was walled and fortified, so was an object of keen contest during the Thirty Years' War. Pop. 6,055.

DURLACH, door'läh, Germany, town in the Grand Duchy of Baden, four miles southeast of Carlsruhe, at the foot of the Turmberg. It is of Roman origin. It has manufactures of iron, machinery, organs, sewing-machines, gloves and beer, and is celebrated for its fruit. Pop. about 14,000.

DURNING-LAWRENCE, SIR **Edwin,** English politician and Baconian: b. London, 2 Feb. 1837; d. 21 April 1914. He was a graduate of University College, London, and was called to the bar of the Middle Temple 1867. He represented as a Unionist the Truro division of Cornwall in the House of Commons, 1895–1906. He published in 1910 an ingenious work, 'Shakespeare is Bacon,' in which he attempted to prove that the plays of Shakespeare were written by Francis Bacon, of which an abridged version, 'The Shakespeare Myth,' was published in 1912. He was created a boronet in 1898.

DUROC, dü-rōk, **Michel Gérard Christophe,** Duke of Friuli, French soldier: b. Pont-à-Mousson, 25 Oct. 1772; d. Bautzen, 22 May 1813. He served as aide-de-camp to Napoleon in the Italian and Egyptian campaigns. In 1805 he was made grand marshal of the palace and was frequently employed in diplomatic missions, though he still took his full share in the wars of France till the time of his death. He was a great favorite of Napoleon and was killed by his side at the battle of Bautzen.

DURRA, door'ra. See SORGHUM.

DURRETT, Reuben Thomas, American lawyer: b. Henry County, Ky., 24 Jan. 1824; d. 1900. After studying at Georgetown College,

Kentucky, he was graduated at Brown in 1849 and at the law department of the University of Louisville in 1850, and practised his profession in Louisville until 1880. From 1857 to 1859 he was editor and half owner of the Louisville *Courier*. He was the founder of the Public Library of Kentucky, of the Louisville Abstract and Loan Association and of the Filson Club of Louisville. He collected one of the most valuable private libraries in the Southwest. He published 'The Life and Writings of John Filson, the First Historian of Kentucky' (1884), and contributions in various periodicals.

DURUY, dü'rwē', **Victor,** French historian and statesman: b. Paris, 11 Sept. 1811; d. there, 25 Nov. 1894. He was professor of history in the Collège (afterward Lycée) Henri IV prior to 1861. In 1862 he was appointed inspector-general of public instruction and professor at the École Polytechnique, and in the following year Napoleon III made him Minister of Public Instruction. During his six years' tenure of this office he carried out many important reforms in spite of the determined opposition of the clerical party, and on resigning his office in 1869 he was nominated a member of the Senate. He was elected a member of the Academy of Inscriptions in 1873, and in 1884 a member of the French Academy. Besides many excellent school manuals, he wrote: 'Histoire des Romains depuis les Temps les plus Reculés jusqu'á L'Invasion des Barbares' (1870–79), his most important work; 'Histoire des Grecs' (1862); crowned by the Academy; 'Histoire de France' (1852) and other works. He was general editor of Hachette's great 'Histoire Universelle.'

DURWARD, Quentin. See QUENTIN DURWARD.

DURYÉE, dür-yā, **Abram,** American soldier: b. New York 1815; d. there 1890. He was educated in the common schools, and going into business made his fortune in mahogany furniture. He entered the State militia in 1833, was made colonel of the 27th Regiment in 1849 and was conspicuous as a maintainer of order during the riots that prevailed up to 1861. During the Civil War he raised the regiment known as "Duryée's Zouaves," and was promoted to be brigadier-general of volunteers in August 1861, but resigned in January 1863 owing to a disagreement over a question of rank. His gallant services at the battles of Cedar Mountains, Rappahannock Station, Thoroughfare Gap, Groveton, Chantilly, South Mountain and Antietam gained for him the brevet rank of major-general in 1865. In 1874, as police commissioner of New York, he attacked and dispersed a body of communists seditiously gathered together in Tompkins Square.

DUSE, doo'sā, **Eleanora,** Italian actress: b. Vigevano, Italy, 3 Oct. 1859. Her childhood and early youth were filled with sorrow, arising from poverty, hardships, the loss of friends and an unworthily bestowed affection. Hers was a lineage of actors, and her early environment destined her for the stage. Her grandfather founded the Garibaldi Theatre in Padua. She was dragged about the minor theatres of Italy in her father's companies, playing Cosette in 'Les Miserables' at 7, and star of the little troop at 13 in 'Francesca da Rimini.' When she was 14 she played Juliet at Verona, in an open-air theatre, her performance compelling recognition as most extraordinarily brilliant. Still she had to wait for general recognition until 1879, when she played Zola's 'Thérèse Raquin' in Naples in 1887. She appeared in Venice in 1892, and later in all the chief European cities, making her debut at the Fifth Avenue Theatre in New York as Camille in Dumas' play of that name, January 1893. Among the rôles which she has triumphantly essayed are Marguerite, Magda, Paula, La Femme de Claude, La Locandiera. She was married to an Italian actor-journalist, Signor Chechi, before she was 20, but they soon separated. Duse has remarkable emotional power and the ability to represent suffering and to make the most of tragic situations, at the same time possessing such versatility that she can play parts of opposite character the same evening. She pays little attention to the meretricious accessories of the stage makeup. Great simplicity and naturalness, coupled with striking intensity, characterize her acting. She has great excellence in diction and in facial expression, the latter being continuous and minute. Her repertory is enormous, her art including the plays of Dumas, Scribe, Verga, Prega, Ibsen, Sudermann, d'Annunzio, and Shakespeare. Her association with D'Annunzio lasted for many years, and it was for her that a number of his plays were written. Her splendid interpretation made them great successes on the stage, and added to the fame of the author. After 1899, a disagreement arose between them, and although she often starred in his dramas, they ceased to be friends. Her tours in the United States, 1893, 1896, 1902–03, were very successful from the artistic and managerial point of view. After this she acted at intervals in Italy, but her health was such that she was compelled for the most part to live in retirement.

DUSKY DUCK, or BLACK DUCK, a North American duck (*Anas obscura*), closely related to the mallard, but of a prevailing sooty hue in its plumage. It is peculiar in being confined to the eastern half of North America, breeding abundantly in Labrador, and appearing in the United States in winter, when it becomes one of the principal market ducks. Its nest, eggs and general habits are like those of the mallard.

DUSSEK, doo'shĕk, **Jan Ladislaw,** Bohemian composer and pianist: b. Czaslau, 9 Feb. 1761; d. Saint Germain-en-Laye, 20 March 1812. He was trained at Iglau, Kuttenberg and Prague, and afterward was organist at Mechlin and Bergenop-Zoom. At Amsterdam he met with much success, both as a teacher and performer, and here he produced his earliest works for the pianoforte; he afterward resided at The Hague, and in Hamburg, Lithuania, Paris, Milan and London (1788–1800), where he was very popular. In 1803–06 he lived as instructor and boon companion with Prince Louis Ferdinand of Prussia, whose death called forth the beautiful and pathetic 'Elégie Harmonique' (op. 61); in 1807 he entered the service of Prince Talleyrand, and thenceforward devoted most of his time to composition. His works include 12 concertos, 53 piano sonatas, 80 sonatas for the violin, and many smaller compositions.

DÜSSELDORF, Germany, city, the capital of the government of the same name, in the Rhenish province; on the Rhine, here crossed by a bridge of boats, and on the railroad from Elberfeld, 24 miles north by west of Cologne by rail. It consists of the old town in the north, Karlstadt, the new town, and Friedrichstadt in the south, with the suburbs of Derendorf, Flingern, Oberbilk, Unterbilk and other small places. The chief public squares are the Corneliusplatz, with a fountain and a statue of Cornelius; Schadowplatz, with a monument of Schadow; the market-place, with an equestrian statue of the Elector Johann Wilhelm; and the Burgplatz, with the tower of the castle which was founded in 1710 and burned down in 1872. In 1896 a bronze equestrian statue of the Emperor William I was unveiled. The principal churches are Saint Lambert's, a 14th century Gothic building, near the Rhine, adorned with marble monuments of Wilhelm IV and Johann Wilhelm, the last two dukes of Clèves and Berg; and Saint Andrew's, completed in 1629. Other buildings are the Academy, a modern building in the Renaissance style; the courthouse, with Schadow's last oil-paintings; and a building of the 16th century, also with fine paintings. The Academy of Art was founded 1767 by the Elector Theodore, remodeled in 1821 and afterward directed by Cornelius and Schadow. This city has the honor of having founded a school of painting, which takes the name of Düsseldorf. While without the traditions of cities like Cologne, Frankfort and Aix-la-Chapelle, not so distant, this metropolis of the lower Rhine, situated on both of its banks, has a fame of its own in history, commerce, art, industry and education. Its name is derived from the brook Düssel which flows into the Rhine. More than 1,000 years old, it was for centuries the residence of the counts, later the dukes of Berg, then the electors of the Pfalz, and finally the grand duchy of Berg, created by Napoleon, until taken by Prussia on 3 May 1815. It owes to its electors its early fondness for art and later its Academy of Arts, which has richly developed within recent decades, containing, in 1910, 14,000 original paintings, 24,000 engravings, 248 water colors copying Italian originals. The expansion of German industry under the empire has had a marked influence on its commerce and trade. In 1850 the population was 40,000; in 1900, 210,000; 1914, 400,000. Its area is about half as large again as Paris. Within a circle of 50 kilometres are three and one-half millions of people. In 1883 the Düsseldorf State Railway stations sold 600,000 tickets; in 1911, 5,900,000. In 1883 the goods traffic reached 500,000 tons; in 1911, 1,700,000. In 1882 were 8,000 shops with 26,000 employees; in 1914 20,000 shops with 130,000 employees. Of the city's industries in iron and steel manufactures 1,000 works are busy, employing a third of the population. In the machine industry 150,000 are engaged in all its ramifications. Its gun foundry has 5,000 workers. The city delivers half the gas pipes and one-third of the boiler tubes of Germany. In 1907 in the older part of Düsseldorf were 21 rolling mills and forges, 27 iron foundries and enamel works and 3 tin plate works. Here too scientific and musical instruments are made, gold and silver articles, wire and safes. Here too are textiles manufactured — spinning, weaving, dyeing. There are 10 paper and pasteboard factories; the booktrade is powerfully represented with bookbinding and artistic painting. The chemical industry has 50 works, with glass, porcelain, fire-clay and cement. Artistic carpentry has its many lines of work. The exhibitions of art and industry, which date from 1811, have greatly promoted the city's prosperity, with its vast wholesale business in ironware, chemical products, technical requisites, groceries, oils, grain and wood. The export trade has direct relations with the Mediterranean, with Russia and the Atlantic ports. No less rapidly has developed the banking and credit business. The Düsseldorf Exchange was founded in 1884. The State Railways have 6 passenger and 11 freight stations. The spacious city harbor on the right bank has five basins and an extended water front,— in the service of its commerce are 50 electric traveling cranes with a 20-ton capacity and 5 grain elevators. There is regular direct steamship connection with the upper Rhine and the chief foreign ports. Leaving its commerce and trade, of what else can Düsseldorf boast? Here Heine was born in 1797. The old house where he was born on the Bölkerstrasse has been torn down and replaced by a more modern structure, but the site still attracts visitors who throng in greater numbers to the Academy of Arts and the Art Gallery with their superb treasures and memories of Cornelius, Schadow and Bendemann, as well as the Museum of Art and Trade and the School of Industrial Arts. Then come the theatres with their varied attractions. Düsseldorf is famous also for its musical gatherings, to which the best soloists of the world find their way. The Conservatoire and College for Music Teachers are among the most famous in Europe.

The city does not neglect the intellectual side of life. It has the Country and City Library with 50,000 volumes, including 1,100 incunabula and 500 manuscripts. There are five town public libraries, reading rooms of some private societies and a Heine Library in one room, reminiscent of the poet. Special collections are found in the Historical Museum, the Natural History Museum, the Hetjens Museum, the Observatory and the rich array of technical works in the library of the Society of German Ironfounders. The schools of Düsseldorf are its special pride. There are 90 board schools, with 1,000 classes and 60,000 pupils. Those beginning a trade or in business are compelled to attend either a trade or a commercial continuation school. As voluntary schools are a trade school, a business school and for girls a commercial school. The School of Industrial Art is a higher professional one, and over all is the Royal Academy of Arts (1767). Other high schools are the town academy for medicine (1907) and the academy for municipal administration. There is a police school for police employees. Then as a bridge between board schools and the higher institutes is the Intermediate School for boys. The state supports a gymnasium and a reform gymnasium, the city supports two gymnasiums; the town and the state support two *Oberrealschule* and one *Realschule*. For the girls are three high schools, three intermediate, a school for modern science and a seminary for women teachers. There are high class private institutes for busi-

ness, handwork, cooking, housekeeping, etc. Düsseldorf, too, has frequent public concerts as well as lectures — duly announced on the city's monthly program calendar. Academical courses for general culture are of much significance in developing the educational status of the citizens of all types. It is needless to add that the city, with its 50 or 60 papers, is supplied with every municipal need,— its mayor or manager has been in charge for years, so admirably does he fill his office. It owns its gas, electric and water supply plants, its coal yard and slaughter-house. It owns the tramways. With the better residences of the villa type, the fine public buildings and splendid churches, the many pleasure parks and gardens, the numerous well-equipped baths, the woods on the outskirts, Düsseldorf comes as near to being ideal as is possible nowadays. Among the celebrities associated with the city are J. G. and F. H. Jacobi, Varnhagen von Ense, Peter V. Cornelius, Wm. Camphausen, H. Von Sybel.

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DUST, the fine particles of matter which float on currents of air or settle on surrounding objects. These particles consist of sand, soot, cotton fibre, pollen, fine hair, pulverized excreta of animals, parts of seeds, bacteria, molds, etc. This is the ordinary condition of things. Frequently, as was the case after the Krakatoa eruption in 1883, the atmosphere becomes widely and densely charged with volcanic particles of varied minuteness, the smallest and lightest particles of which must take months, even years, in settling. The dust from this eruption circled round the entire globe several times, and for two years it gave rise to extraordinary sunset glows and other remarkable optical phenomena. The finest particles are believed to have been raised to an altitude of 50 miles and to have remained buoyed up by air currents for several years. The presence of an abundance of pollen in the air accounts for the occurrence of "sulphur showers" or "golden rain." The "dry fog" of 1783, which covered Europe for three months, is regarded as having been due to an eruption in Iceland.

On 8, 9 and 10 March 1901 heavy dust storms arose in the desert region of southern Algeria, were carried north by a great cyclonic storm, leaving deposits as far north as Denmark, Russia and Finland, the last traces of the storm settling in those countries on the 12th of that month. The extreme distance carried was 2,500 miles; the total amount falling on the Continent being estimated at 1,800,000 tons, two-thirds of which fell south of the Alps, and as much more is supposed to have fallen in the Mediterranean. Off the west coast of Africa between the Canaries and Cape Verde Islands, haze dust due to storms from the Sahara Desert is frequently encountered by vessels. The dust storms in certain parts of India are occasioned by accumulations of whirlwind columns moving *en masse* or in rapid succession over the earth's surface in a direct or wavy line. When passing over the arid plains these whirl high into the atmosphere great quantities of dust, which are rolled onward in huge volumes, forming at times a sublime spectacle.

Conflagrations are responsible for the spreading of dust over very extensive areas. Forest fires along Lake Champlain and down to the neighborhood of Ticonderoga caused a night-like darkness to fall on New England on 19 May 1780, the unusual phenomenon suggesting to the inhabitants the coming of the end of the world. Cinders from the great fire in Chicago spread over a very extended area, and reached the Azores 40 days after the outbreak of the conflagration. The burning of peatbogs in the barrens of Labrador is supposed to have been the cause of the "yellow day" in New England (6 Sept. 1881), when the atmosphere had an intensely brassy appearance. The dust of such meteorites as undergo complete combustion on contact with atmospheric air has been traced on the earth's surface; fine ferruginous particles are often found on the snowy summits of high mountains and on the icefields of Greenland and other northern regions. This is called by scientists cosmic dust.

The dust with which the atmosphere is impregnated, especially in cities, is not only injurious to health, but causes loss in business, in addition to which certain kinds are liable to explosion. Damage from dust and soot in departmental stores is a definite loss item, causing depreciation in stock and high charges for dusting and cleaning. The drastic remedy lies in the washing of the air, warmed in winter and cooled in summer, with the humidity adjusted for comfort and health. In such buildings the windows will remain unopened — the open window being regarded as a source of contamination. Air was cleaned at first by passing it through a cheese cloth screen, but a common practice now is to subject it to water sprays, which remove as high as 98 per cent of dust and other impurities, after which it is circulated throughout the building. In the running of pneumatic hammers, drillers and riveters, dynamos and other machines, the elimination of dust where practicable is a great economy which materially lengthens the life of the machinery. In mines, flour mills and other places where dusty operations are carried on, there is constant danger from dust explosions. The amount of dust that must be present to cause an explosion naturally varies to some extent. Among dusts which propagate flame readily and ignite so easily that an explosion would certainly be produced by lighting a match in the dust-laden space are sugar, starch, rice refuse, fine wood dust, malt, oat husks and grain in flour mills. Dusts from leather, shoddy and shellac compositions and sawdust, while they are readily ignited, are not so dangerous, as they ordinarily require a source of heat of larger size and higher temperature or a source that acts for a considerable time.

Aitken, a Scottish savant, has shown that no condensation of moisture, as in rain, mist, fog (see Fog) could occur without nuclei such as dust particles. If the atmosphere were not impregnated with dust there would be no cloud effects, no radiant sunsets, no soft afterglow; the sun would go down instantaneously, the harmonious colorings which lend a halo to the quiet of eventide would never have been. Aitken has also devised an apparatus for gauging the number of dust particles in a given

sample of air or gas. He and others have made innumerable tests in all parts of the world. The number of particles varies from a few thousand per cubic inch over oceans and in mountain regions to 50,000,000 and upward in dusty towns. A room near a ceiling has been found to contain 88,000,000 to a cubic inch. Aitken regards that a cigarette smoker sends 4,000,000 particles into the air with every puff. A great amount of solid matter is sent into the air as the result of the imperfect combustion of fuel. The dust fall in English cities is estimated at from 200 to 2,000 tons per square mile per annum. Tests made in 1913 showed that 195 tons per square mile fell at Sutton in Surrey as compared with 650 per square mile in the East End of London; in the centre of Leeds 242 tons and Leeds Forge 539; Glasgow and Coatbridge 1,330 and 1,939 respectively. Experiments made in 1914 by the Board of Health of the Department of the Seine on the Paris Underground Railway showed that in the metropolitan section of the road the average constitution of the dust embraced 46 per cent metallic iron, 14 per cent iron oxide, 12.1 lime and plaster, 1.12 grease, 12.6 water and organic matter.

But one of the most important and serious questions concerning dust-laden air is the danger it brings to human life as disseminating the bacteria of disease. Nearly one-fourth of all deaths are due to consumption. Now the expectoration of a consumptive may contain millions of germs. Falling on the sidewalk or carriage-way of a city, it is soon tracked over a large area and gradually mixed with the dust; especially on asphalt pavements, where each wheel acts as a millstone, grinding everything into the finest powder, to be raised by passing vehicles into the air and sent into thousands of healthy lungs. The number of disease bacteria in the air has been calculated by many analyses. Taking 10 litres of air for a basis: in the Boston City Hospital the number of living bacteria was found to be nearly 450, and of molds 225. In a model New York hospital, where everything is supposed to be clean, 12 living germs settled on the disc, and, after sweeping, 226. In a New York tenement-house carpeted living room, 75 living bacteria settled on the disc in an exposure of five minutes; after sweeping, 2,700, and mold settled on a plate or disc three and three-quarters inches in diameter. Precautions are now taken in the majority of cities against the peril of dust-spreading disease by constantly flushing the streets and sweeping away all superficial dust into the sewers.

DUST-BRAND, or **SMUT,** a disease of certain plants, as oats, barley, corn and other cereals. It is caused by a parasite fungi called *Ustilago,* which causes a swelling that at length becomes a powdery sooty mass. The common forms are *Ustilago segetum* and *U. carbo;* that which attacks Indian corn is *Ustilago maydis.* See FUNGI.

DUSTIN, Hannah, American heroine; she was the wife of Thomas Dustin and was captured by the Indians during their attack on Haverhill, 16 March 1697. Her youngest child, an infant one week old, was killed, but her husband, with their other seven children, was successful in escaping. The mother, with her nurse, Mary Neff, was carried off and put in charge of an Indian family consisting of two men, three women and seven children. The captives on their way to a large Indian village halted at an island six miles above the present Concord, N. H. Here Mrs. Dustin and her nurse, assisted by an English youth, Samuel Leonardson, killed and scalped all the Indians in their sleep, excepting one squaw and a small boy, and after a difficult journey in which they endured many hardships reached home in safety.

DUSTY-FOOT COURT. See PIEPOWDER COURT.

DUSTY-MILLER, a common name of some of the plants of the genus *Primula* of the primrose family, from the white flour-like appearance of the leaves. The name is also applied to *Senecio maritimus,* a native of the Mediterranean region and much grown in gardens.

DUTCH, the anglicized form of the word *Dietsch, Duitsch* or *Deutsch,* which in the Middle Ages was applied to the Teutonic people who spoke a language other than the Latin or the Romance languages. *Dietsch* means, "belonging to the common people; vernacular." While the term Dutch was once applied by the English, and in the United States is still popularly applied, to German-speaking peoples and things German, its use is properly restricted to the language and people of the Netherlands. The people of Holland call themselves *Nederlandsch* and use their forms *Duitsch, Nederduitsch,* as the Germans do *Deutsch, Niederdeutsch.* For Dutch language and literature, see NETHERLANDS.

DUTCH IN AMERICA, The. Set like a wedge at the meeting point of the Celtic and Teutonic races and at the mouths of the rivers flowing out from the continent, the evolution of civilization in the Low Countries proceeded notably on the lines of industry and democracy. By the sixteenth, the century of exploration, the 17 provinces, with their 216 walled cities, had become the richest part of Europe. After the struggles of the Renaissance and the Reformation, the Netherlands were cleft in twain, forming two countries, the one becoming an appanage to the Spanish monarchy and the other an independent federal republic. The 10 southern provinces returned to their old allegiances, ecclesiastical and political, and all adherents of the Reformed faith were expelled. The refugees, mostly skilled artisans and educated people, added notably to the wealth and power of other countries, especially to the Dutch Republic, which quickly doubled in population and became a world power. It was from this country that the Dutch who settled New Netherland came. By this time the nation that was to give organic life to our four Middle States had developed men, women and institutions that were the wonder of the world. Representative government in Church and State — the judiciary being supreme — was a cardinal feature and free public education for both sexes was nearly universal. These republicans led the nation in freedom of conscience, of speech and of the press, as well as in public charities, prison reform, land distribution and registry, legal codes and municipal administration; as well as in several minor matters, such as the written ballot, the uniformity of road gauge, with the law of turn-

ing to the right, in making wedlock a civil ordinance with public registry, equal distribution of property to children, the protection of the rights of women, etc. On Holland's soil, in 1619, was held the first ecumenical council of the Reformed Churches of Europe. On the roll of her eminent sons were the names of Agricola, Gansevoort, Thomas á Kempis, Erasmus, William the Silent, John of Barneveldt, Grotius and Maurice, besides painters, scholars, jurists, divines and musicians without superiors in Europe — a list to be mightily increased during the next two centuries following the beginnings of New Netherland.

After the triumph of the forces of union and nationality over those tending to disruption, colonization began, the Dutch sons and daughters, in their youth, vigor and alertness, carrying their ideas, faith, customs and institutions with them. They did not go from home as political or religious exiles, for they had no need to be such. They were not in protest against their government in Church or State, for their freedom of conscience and civic rights had already been won at a great price. In New Netherland the framework of order was first under a trading corporation and later under a system of manors and free towns; but the semi-feudalism thus introduced had been outgrown in Holland and in the New World cut across the grain of the Netherland spirit. The story of the Dutch in America, apart from economics and agriculture, is that of two streams of movement and influence. The one was of a democratic bias, nurtured in the Church, and the other that of officialism and corporational life; the one ineradicable because entrenched in the traditions of free government guaranteed by charter. The other was of survivals of feudalism in the stronghold of aristocratic bureaucracy. One was to abide, the other was to pass away. On the first stream of tendency floated such figureheads as Van Twiller, Kieft and the able governor Stuyvesant, who detested popular freedom. On the other and permanent current arose such noble characters as Peter Minuit, Sebastian Krol, Domine Michaelius, Melyn and Kuyter, who all withstood Kieft; Adrian Van der Donck, who fought Stuyvesant's usurpations; Arendt Van Curler, founder of a free town; and Jacob Leisler, the people's champion against monopoly and aristocracy. When the chronic contention between these two forces was hottest came the English conquest. The question was never settled by the Crown lawyers as to whether the new province was proprietary or royal, but the people constantly resisted the invasions of royal prerogative and state-churchism. The Dutch, being in overwhelming majority, clamored for a franchise equal to that in force in Pennsylvania, where Penn had borrowed much directly from the Dutch Republic. In the first session of the Assembly in 1683, the people of New York, through their delegates, formed the Charter of Liberties, in which first of all, in an American document, the words "the people," as holders of authority, was used. James as proprietor signed this enactment in 1684, but on becoming king he annulled the charter. The sequel was seen in Andros, and in Leisler, whose so-called usurpation was the holding of New York for Dutch ideas; that is, freedom of religion, the destruction of the flour monopoly and the restoration of rights to which the Dutch Republicans had been accustomed. The Reformed churches secured charters from King William III, and aided by other "dissenters," kept up the fight for freedom of conscience and the press, until the constitution of New York, in 1778, was formed. This led all others in eliminating the question of personal opinion on ecclesiastical subjects from the fundamental law — an example later followed by all the States. In the Revolution the chief battleground was in the middle region where Dutch were numerous, and no people, as a body, were more loyal to the Continental Congress or suffered more, the leading families throwing their weight of influence and example with the patriots, while the ministers and churches were especially marked for British vengeance. The Dutch guns at Saint Eustatius, where half of the war supplies were obtained, boomed out the first foreign salute to the American flag. New York, besides filling promptly her quotas of money and supplies, sent 43,645 men to the army, a number, in proportion to population, excelled by none of the other colonies. The Lansing family, as a specimen, furnished 73 soldiers. To Philip Schuyler belongs the real credit of Burgoyne's defeat and surrender. The constitutional fathers showed close familiarity with Dutch precedents and profited by them. In the century following, the names of Van Buren, Roosevelt, DeForest, Vanderbilt, Pennypacker and of hundreds of other eminent individuals and families prove the virility of the stock. After 1840 Dutch emigration, of a quality perhaps excelled by none, recommenced and in a few years 100,000 Netherlanders settled in the West, chiefly in Michigan, Wisconsin and Iowa. They cleared the forests, tilled the soil, initiated new enterprises and built schools and colleges. During the four eras, under which the inhabitants of the middle region have dwelt under as many national flags or civic emblems, each one of the latter has been a symbol of union. The totems of the Iroquois stood for a forest republic, federated first of five, then of six nations. Following these was the seven-striped flag of the Dutch Republic — the historic basis of our own national ensign, in which each stripe represents one of the original covenanting States. The oft-changed flag of crosses, from 1664 to 1775, was significant of the four nations of the British Isles. Finally the world saw the 13-striped flag of 1775–77, and then "Old Glory," of which the first actual use, known to documents and contemporaneous written testimony, was at Fort Schuyler (Rome, N. Y.), 3 Aug. 1777. No wonder then that the middle region, first settled by the Netherlanders, has always been for union! With the passing of time and fashions the descendants of the Dutch have changed their language and some old customs, but not the principles learned under the republic of their fathers, which gradually became the law of the new land. The Empire region has ever avoided the centrifugal tendencies so marked in the extremities — in New England until the Hartford Convention, and in the South when cotton was hailed as king. In this region, once called New Netherland, most of the ideas, institutions, economic advantages, great inventions, notable books and those contributions to

civilization, which are recognized as distinctively American, originated or were developed. The legend of unmixed English culture in the making of our Republic which has so distorted American historiography is not held by scholars familiar with the Dutch language and history and with the testimony of American witnesses. On the contrary it may be said that in matters linguistic, literary and human, the American people are as much the teacher of the British nation as they are the pupil of the Netherlands.

The Dutch in the United States.—The first book in English on America was a translation from the Dutch in 1520, and published in London by Laurent Andrew, a Dutchman. Besides printing, England was for nearly two centuries indebted to the Netherlands (100,000) refugees in 1567– for many of the economic features of modern civilization, as records, proverbs, obvious facts show. The animating motive of Henry Hudson, in a Dutch ship, was to obtain the reward of 25,000 gilders offered by the States-General for the finding of a new route to China. New York was cosmopolitan from the beginning — a true type of the American commonwealth — which is made up of all nations, yet with high ideals, that were nourished as well on the Continent, as on the islands of Europe. Its sea front was first discovered by an Italian on a French ship, and later by an Englishman on a Dutch vessel. There is no such region as New Netherlands, nor ever was, but when the land between the Delaware and Connecticut rivers had been explored and "figuratively" mapped by Captain Ney, it was called New Netherland, that is, a new province, not of the Belgic but of the seven northern provinces of the Netherland, or the Dutch Republic, whose truce with Spain made in 1609 prohibited military occupation or settlement until after 1621. Ignoring fishermen, fur traders and temporary squatters who came for a season, the first home-makers in the region of the Middle States were refugees. Netherlanders from the southern or Belgic part of the old 17 provinces, who spoke French and were of the Gaulish race, or Walloons, g and w being interchangeable in the languages. They came in 1624 on a ship of the Dutch West India Company, named after the new province *New Netherland*. After these people followed the Dutch in large numbers, every one of the seven provinces being represented, who settled within the limits of what are now the four Middle States, New York, New Jersey, Pennsylvania and Delaware, though a few found homes in western parts of Massachusetts and Connecticut. The total number of emigrants from "Patria," as they called the Republic, from 1624 to 1664, was not over 15,000, with a probable increase by natural generation, which balanced the loss of the 5,000 or so of those who, not willing to live under the English rulers of the Stuart dynasty, returned to the "state without a throne." One great advantage enjoyed by the Dutch in North America, during the 40 years of their corporate political life, was that they were all under one social and governmental system, typical of the future American national commonwealth, with a single language and (the overwhelming majority) of one religion. Whatever limitations these people were under, or whatever their admirers or detractors allege, they brought to the new continent the traits of character, habits, customs and institutions, to which they had been used for centuries, or which were nascent in a time of reformation and progress, during which the Republic led the world. Certainly no emigrant ship to America excelled in cleanliness of the ships, or the character of their human cargo, or in what they left in vitality behind them or imported on this continent. The *Half Moon* of 1609 and the *New Netherland* of 1624 had no superiors in personnel or principles represented, for the Dutch Republic was in the van of ideas now generally accepted by the modern civilized world. Some of these familiar facts were, toleration of religion, freedom of printing, public schools (established since the 12th century by the Church and later sustained by taxation), the principle of treating aborigines as men — the purchase of land from the Indians being obligatory and set down in the charter — the rule of the road — turning to the right — the standard gauge for roads, marriages recorded by the magistrate as well as by the church, universal registration of deeds and mortgages, the equal division of property among children of the same family, and many other things not then known, or at least not in operation in England. That the Pilgrims gained much enlightenment and learned to do many things "according to the laudable custom of Holland" (as Bradford, before Longfellow, tells us) is patent to all critical students of historical perspective, i.e., of what existed, or did not exist, in the two countries of England or Holland before 1664. In the discussion as to how far the development of the American commonwealth has been influenced by the Dutch Republic, the important point for the truth-seeker is to be familiar with what was known in the Netherlands and contemporaneously unknown in England, and vice-versa, during the days of exile of the Pilgrims, from 1609 to 1621, and during the time of the Tudors and Stuarts, also, when many if not most of the Puritan leaders of New England found refuge within the Republic. It was in the Dutch armies, that every one of the military leaders in the American colonies was trained. England, and her three insular peoples, Welsh, Scotch and Irish, had thousands of volunteers or regulars in the republican armies during the 80 years from 1568 to 1648, of the Dutch war for freedom. A large number of these veterans afterward came to America. The colonial fathers, revolutionary leaders and constitution makers of the American commonwealth, were far more generous in acknowledging their debt to the Dutch Republic, than the historiographers of later times, under whom the legend of unmixed English culture grooved out the channels of American public notions and opinions. Washington Irving's caricature of the 'History of New Netherland' — although he had never, before its writing, seen but a small fragment of one or two Dutch southern provinces — has actually been taken for serious history. Its pictures have certainly colored the views of American writers to an extent almost equalling that of a German savant, who annotated, with comments in Latin, one of Irving's broad jokes, taken by the Teuton in all seriousness. John Adams declared that "the originals of the two republics are so much alike, that the history of one seems but

a transcript from that of the other." When the first envoy of the sister republic, that sheltered Pilgrims and Puritans, came before our Congress, Benjamin Franklin, in his letter of commendation, wrote, "in love of liberty and bravery in defence of it, Holland has been our great example." Jefferson and Madison repeatedly pointed to the Netherlands as a good example for American imitation.

Yet no scholar or even sensible man could imagine, in the 16th and 17th century, the stage of progress attained in the 20th century, while it is freely granted that in other nationalities there were elements of progress and features worthy of being borrowed. The main point to settle by comparative research is what actually existed in the formative days, on either side of the North Sea, when British exiles from home and intellectually sensitive, as the Pilgrims and Puritans were, were being prepared for their adventures and experiments beyond the Atlantic.

As a matter of fact, the English language overcame in the American colonies not only Gaelic, Erse, Welsh and dialectic Anglicisms and Briticisms (later supposed by the insulars to be "Americanisms"), but also Dutch, French, German, Swedish. Hence the actual knowledge of what the Dutch contributed, as visible leaven or obvious reality to American life, sunk into oblivion. No historian or widely popular first-class writer of American history, except Brodhead, and possibly John Fiske, is known to have been a critical scholar in Dutch history or the language, or to be topographically or socially familiar with the Netherlands in America. It is certain that the treatment of neither Motley nor Fiske on the special points herein mentioned satisfies Dutch critical scholars. Nevertheless, in the revival of pride in Dutch ancestry and of the commercial reciprocation of advantage, through the Holland Societies and Netherlands Chambers of Commerce, and the relatively greater increase of population and prosperity of the Middle as compared with the Eastern States, there have come, since 1876, when our national origins were more inquired into, a new trend of opinion and a greater willingness to acknowledge our ancestral and ethnic debts. With the coming, since 1846, of over 100,000 Dutch immigrants of high character and abilities to the United States, chiefly in the Middle West, and the establishment of the Holland-America line of steamers, stimulating visits to the old home and travel therein, with the endowment of professorships of the Dutch language and literature — so long disgracefully absent from our universities — there has developed a more pronounced pride in Dutch ancestry. The history of human nature and the world shows that when men receive new light or knowledge on themes long neglected, they are apt to run to extremes of thought and expression. The chronic trouble, in this particular line of truth-seeking, whether with the flamboyant after-dinner orators or those who hold stalwartly to the legend of unmixed English culture in the making of America, is a lack of accurate or abundant knowledge of the Dutch language and the real history of the Dutch people. The last sources for these are to be found in the average English histories, over which Dutch scholars have their fun. Besides, a judicial mind is needed, above all things, to keep in view the fundamental fact of modern Dutch history — that "the state without a throne" (1579–1813) was created by the Church, and that independence and national evolution were the work of a people stirred to revolution and driven to creative energy by religion, even more than by economic or political pressure. Motley declared that in all Dutch history "the real hero is the people," but neither he, in his brilliant narratives, nor the ordinary writer in English took right thought about the average man in mass, the actual people. Throughout the whole Netherlandish story, whether of the democratic Belgic communes or the northern republic, local freedom was large, prolonged and persistent even till to-day. In every political organism, it seems vital to real progress that there should be rivalry between two elements and an opposition of parties. Obvious in a republic, this is visible to a degree even under more or less of apparently real autocratic form of government. In the Dutch Republic, the city magistrates and the office-holding class, generally, were on one side — the obvious one and the element almost exclusively represented in the documents and books, from which most closet historians take their ideas of reality. The other and numerically much larger class and, in the long run, most potent, even after institutions had changed or passed away, were the people. William the Silent knew this, for he appealed first to kings, then to nobles, and both failed him. He appealed then to the people and they responded and he won. In both the Old and the New Netherland, the people were in the Church and perdured through all changes. It is beyond all controversy that it was the Dutch people, and not Maurice as against Barneveldt, that secured the national Synod of 1618, vindicating nationality, which in the near generation flowered in art and literature under the triumphant republic. When and for long afterward New Netherland became New York, things were slightly altered, but at the top only. The Netherlanders, who came to America from 1624 to 1664, were those of the Dutch heroic age, many of them veterans of the armies of freedom. Certainly they were the very antipodes of the sort caricatured by Irving, who, from selected specimens in peaceful times and in back country districts over a century afterward, formed his lay figures and men of straw. As a matter of fact, after the English conquest, the people remained. Their rights being guaranteed by treaty, they elected their own church officers, kept out the Anglican state church officials from their pulpits and pale, and resisted every effort of the king's favorites, their royal governors, to establish a form of religion more or less influenced by political rulers. For 114 years, from 1664 to 1778, when full freedom of conscience for all was guaranteed in the state constitution — which led all others in this respect — they kept up the good fight. It was on the soil of New York that the battle of religious freedom which resulted in victory for the nation was fought out and won.

It is only by knowing the spirit of the people and the interior history of the Reformed Church, in either one or both of the Netherlands, that a clear perspective can be gained. It was in the Middle States, where the Dutch leaven and elements were so strong, that the

centrifugal tendencies of both the Eastern and the Southern States, as shown in secession or threats of it, was with the help of the West ultimately overcome and the "more perfect union" of which the Dutch Republic, which had gone through all the experiences of National Supremacy vs. State Sovereignty, of secession and coercion, and of the ultimate triumph of national over all lesser elements, was a prototype and was forever established, even the kingdom of 1813 being a disguised republic, fulfils the hopes of the old federation.

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WILLIAM ELLIOT GRIFFIS,
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DUTCH CHURCH, the church to which the majority of the people of Holland adhere. In the 16th century the Dutch wavered for a time between the Lutheran Church, whose leader was the great reformer, and the Reformed Church, whose leaders were Calvin and Zwingli. In 1571 they publicly professed their allegiance to the latter by embodying its doctrines in the Belgic Confession of Faith, published in that year. As long as they were under the sway of the Spaniards they, however, abstained from the use of the word Reformed, which had been introduced by the French, and styled themselves "Associates of the Augsburg Confession," the Spaniards considering Lutherans more easy to govern than Calvinists. One of the most notable events in the history of the Dutch Church, after the yoke of Spain was broken, was the Synod of Dort, in 1618. James Arminius, professor of theology at Leyden, having rejected the Calvinistic tenets and adopted those which were destined to be called after himself, Arminian, a synod was convened at Dort to examine and, if need be, condemn his views. This was done, but with little effect, the views of Arminius prevailing to a greater extent after than they had done before their condemnation. The government of the present Dutch Church is Presbyterian. See REFORMED CHURCH IN AMERICA; LUTHER; NETHERLANDS; REFORMATION; ZWINGLI.

DUTCH CLOVER, a common name for the white clover (*Trifolium repens*), a valuable pasture plant, very common throughout the United States, naturalized from Europe. It is also a native of Siberia and is found in all temperate regions. It has a creeping stem, the leaflets are broad, with a horseshoe mark in the centre, and the white or pinkish-white flowers form a roundish head. The plant is so well known that it has a variety of familiar names, the best-known English names being sheep's-gowan, honey-stalks, lamb-sucklings and occasionally shamrock. See CLOVER.

DUTCH CONCERT, the term applied to a social entertainment in which every man sings his own song at the same time that his neighbor is also singing his. Another form is that in which each person present sings in turn one verse of any song he pleases, some well-known chorus being used as a burden after each verse.

DUTCH COURAGE, false or fictitious courage, usually applied to the bravado excited by means of partial intoxication. The phrase probably originated in the 17th century, when England's wars with the Dutch, and especially the naval reverses England suffered at their hands in the reign of Charles II, rendered in England the name "Dutch" an offensive epithet.

DUTCH EAST INDIA COMPANY. See EAST INDIA COMPANIES.

DUTCH EAST INDIES, the islands in the Malay Archipelago owned by the Dutch; situated between 6° N. and 11° S. lat., and between 95° and 141° E. long. The names, area and population of the divisions are as follows:

Divisions		Area: English sq. m.	Population, 31 Dec. 1912
Java and Madura		50,554	36,015,435
Island of Sumatra	Sumatra, West Coast	31,649	1,219,515
	Tapanocli	16,167	708,585
	Sumatra, East Coast	35,312	769,265
	Benkulen	9,399	214,272
	Lampongs	11,284	159,219
	Palembang	53,497	724,234
	Djambi	19,038	208,236
	Atjeh	20,471	789,664
Riau-Lingga Archipelago		16,301	184,460
Banca		4,446	113,653
Billiton		1,863	58,480
Borneo, West Coast		55,825	467,158
Borneo, South and East Districts		156,912	905,301
Island of Celebes	Celebes	49,390	1,977,455
	Menado	22,080	700,236
Molucca Islands		43,864	561,062
Timor Archipelago		17,698	950,067
Bali and Lombok		4,065	1,207,310
New Guinea to 141° E. long		151,789	200,000
Total		771,604	48,123,707

The areas given are accurate; but, except for Java and Madura, the population is estimated. The figures, however, are approximately correct, as the official records give the census every five years. The population of some unexplored sections is not included. The last official returns give the total population, approximately 48,000,000, or about seven times as large as that of Netherlands. The number of Europeans in Dutch East Indies in 1912 was 80,910; of Chinese, 563,000; of Arabs, 29,000; of people from parts of Asia other than China and Arabia, 23,000, and about 37,200,000 natives. The chief occupation of the people is agriculture. The greater part of the land of the island of Java is government property, but in the western part there are a number of private estates. Formerly the government or the private owners of estates were entitled by law to one day's gratuitous work each week from each laborer on the estate, or, instead, to the payment of one guilder per head annually. In 1882 the greater part of these enforced services was abolished, and the remainder in 1914 in return for an increased poll-tax. Since the passage of the "agrarian"

law in 1870, which granted waste lands on hereditary leases for 75 years, agriculture has increased in Java and the other islands. At first the government raised all the most productive articles as sugar, coffee, rice, etc.; but since 1891 the government has ceased to cultivate sugar, and it is now grown on the lands hired by the natives or on lands held on emphyteutic tenure from the government. All the usual products are cultivated on private estates. The annual production of sugar has greatly increased, amounting in 1914 to 1,363,380 tons; the amount of coffee produced has decreased, amounting only to 38,718 tons in 1914; cinchona has increased rapidly, amounting in 1914 to 1,626,970 pounds; tea, tobacco and indigo have increased steadily. The yield of the tin mines of Bilton and Riouw and of the coal mines of Java, Sumatra and Borneo have increased each year. Buffaloes, oxen, cows and horses are raised extensively. In India horses are not used for agricultural purposes.

Manufactories are increasing slowly; rice-mills, saw-mills, soap factories, ice and soda water manufactories are in some of the towns. The principal articles of export are sugar, coffee, tea, rice, indigo, cinchona, tobacco, coprah and tin. Nearly all of the exports, except rice, go to the Netherlands. The railroad and the mail and telegraph service is fair and is becoming better each year. The local revenue derived from land, taxes on houses and estates, from licenses, custom duties, personal imposts, some indirect taxes, and from the government monopolies of salt, opium and railroads and the sale of government products. About one-third of the annual expenditure is for the army and navy, another third for the general administration and the balance for the local government administration. The "Java Bank" is controlled by the government. There are two other Dutch banks, several branches of banks in Great Britain and a number of savings banks. The legal coins and the weights and measures are the same as for Netherlands. The local weights and measures are as follows:

The Amsterdamsch Pound	= 1.09 lb. avoirdupois.
" Pikol	= 133⅓ lbs. "
" Catty	= 1⅓ lb. "
" Tjengkal	= 4 yards.

In the administration of justice the principle observed is that Europeans and those assimilated with them are subject to laws nearly similar to those in vogue in the Netherlands, and the natives are subject to their own customs and institutions. The administration of justice for Europeans is in charge of European judges, while that for the natives is almost wholly in charge of native chiefs.

Schools are provided for all Europeans and natives. In 1913 there were 10 public intermediate schools and 5 private intermediate schools. In 1914 there were for Europeans 191 mixed public elementary schools and 22 for girls only (24 for Chinese only), with 34 private schools; the elementary schools for natives were 834 government schools and 494 private schools.

Entire liberty of worship is granted to the members of all religious denominations. Christianity is increasing among the natives. In Java and the outposts, in 1914, there were 600,000 Christians.

In 1602 the Dutch created their East India Company. This company conquered successively the Dutch East Indies and ruled them during nearly two centuries. After the dissolution of the company in 1798 the Dutch possessions were governed by the mother-country. The superior administration and executive authority of Dutch India rests in the hands of a governor-general. He is assisted by a council of five members, partly of a legislative, partly of an advisory, character. The members of the council, however, have no share in the executive. The governor-general and members of the council are nominated by the queen. The governor-general represents not only the executive power of government, but he has a right of passing laws and regulations for the administration of the colony, so far as this power is not reserved to the legislature of the mother-country. However, he is bound to adhere to the constitutional principles on which the Dutch Indies are governed, and which are laid down in the 'Regulations for the Government of Netherlands India,' passed by the king and States-General of the mother-country in 1854, and altered many times since. For administration purposes the various possessions are divided into residences, divisions, regencies, districts and dessas (villages), each governed by a resident governor of contrôleur, etc.

For defense there is a colonial army entirely separate from the home army. It consists of about one-quarter Europeans to three-quarters natives. Its strength in 1915 was 1,285 officers and 37,041 men, of whom 8,557 were Europeans. There is also a small colonial reserve of both Europeans and natives. There is a navy, maintained by the mother country, consisting of 27 vessels, with a complement of 237 officers and 2,059 European and 1,329 native non-commissioned officers and sailors. There is besides the colonial navy consisting of 22 small ships, with 167 Europeans and 766 natives, employed for civil service duties. The expenditure for defense in 1915 amounted to $27,367,500.

DUTCH AND FLEMISH FURNITURE. Under the rule of the dukes of Burgundy Flanders was brought to the zenith of perfection in some branches of the industrial arts, especially tapestry weaving. But not until the 15th century do we find any pieces of movable furniture conforming to our idea of that word. Great coffers (*huches* or *bahuts*) acted as chairs, beds and closets for holding the tapestries, clothing, bedding, etc. They showed rough carving in Gothic motifs, but more often were covered with floriated iron bracing and wide-spreading branched lock escutcheons. The churches and monasteries alone had artistically designed pieces consisting of pulpits, reading desks, choir-stalls, etc. We have a few extant closet doors, the recesses of which closets were built into the wall; these doors were panelless boards held together with strap-hinges that straggled across the entire surface in Gothic scroll work and held them together. The tables were boards set on trestles. But the rise of the bourgeoisie with their powerful communes and the corporations and guilds brought not only peaceful conditions but a height of luxury and wealth that made Flanders the envy of her greater neighboring kingdoms. And, late in the 15th century, to the luxurious wealth of cush-

ions, carpets, tapestries and stamped and gilded leather work are added pieces of furniture that afford both body comfort and artistic effect to a certain degree. And at last we are able to discern a difference between the furniture of the church (*hieratic*) and that of the palace (*profane*) or dwelling of the wealthy. Carved and paneled pieces appear in the ladies' chamber, painted in red heightened with white rosettes; there was no bedroom, but the chamber had a bed, bench and armchair as well as a sideboard (*dressoir*). Still the bed was often a long chest on short legs, covered with a mattress and pillow and protected at the sides with curtains to keep off the draughts and above by a canopy suspended from the ceiling. In the lining of the walls were often closets, the window frame afforded a seat, and there were settles and benches. Sliding doors, later, disclosed shelves in the wall, on which were books, glass, plate ware, clothes and food; thus they served as cabinets, bookcases, cupboards, wardrobes and larders. They were primitive *armoires*. But the chair was still a chest with supports and a back added, and the sideboard (*dressoir* or *credence*) was also a chest but supported on legs and topped with a dais or canopy. The carving of the panels ran to "linen fold" ornament, the rest to Gothic "tracery." But paneling was only done for churches till after the middle of the 15th century. The chimneypiece became quite ornamental (a number are extant) and had overmantles with arabesque carving on the supports and elaborate many-membered moldings in the overhanging cornice high above. Decorative Dutch tiles appear sometimes on the hearth and sides. Some of the mantles show painted decoration, generally armorial bearings. Brackets and consoles appear now, with carving, though immovable. Meals were taken in the great main hall, which was furnished with a dressoir (buffet), trestle table, forms for seats (no chairs except for the lord and ladies and the guests. Great buffets (*dressoirs*) are recorded of the Burgundian period. Thus we read that when Philip the Good married Isabella of Portugal "there was a *dressoir* 20 feet long on a platform, and it had five stages (*gradins*), the three upper ones loaded with vessels of fine gold, and the two below had great vessels of silver-gilt." These dressoirs were beautifully carved in Gothic traceried doors and panels; some had numerous doors and also compartments in the lower space. A three-legged stool appears about this time, having the rear leg extended and spread out and deflected back at an angle of about 40 degrees so as to form a back. The rear of the seat diminishes almost to a point. Contemporary pictures show cavaliers sitting straddle-legged and facing the back of these while using the back to rest the arms and hands upon; there were also a few four-legged chairs — all had very heavy lathe-turned legs. A very heavy boxed seat was the *hokker*, which was provided with arms and had the sides and back boarded in to a considerable height and roofed with a pediment. Other pieces were the bedstool to mount to the high bedding; reading desk, washstand, framed mirror and fire-screen. The Flemish woodcarvers were becoming so skilled that their services were already called for in England, France, Spain, Italy and even Germany. Among the noted Flemish masters of the 16th century working in Antwerp we find the names of Hans and Adrian Collaert, Hans Liefrinck and Cornelis Matsys.

Renaissance.— By 1530 the Netherlands had developed their Italian influence, but they retained their "linen fold" motif in carving into the 17th century. The earliest Renaissance Flemish furniture was, of course, copied from imported pieces, but the native woodworkers were soon greatly aided by the designs of Cornelis Bos, Frans Floris and Alaert Claas, Lucas van Leyden, Jean Vredeman (called de Vries), Theodore de Bry; Hugues Sambin and Pierre Coech also helped, as did the Italian designs of Serlio. The boxed seat and stiff perpendicular back gave way to open work chairs, the four legs are now clearly defined, the back loses its stiff uprightness and leans to the rear; it is a light, movable piece. But, as is always the case when styles change, we find many *transition* pieces, modifications of the Gothic decoration, but not entirely representing the Classic. Another change is the partial displacement of the former universal oak by the use of walnut as a medium. In this 16th century product we later get the carved work decoration in high relief caryatids, grotesque figures, herms, acting as supports, often combined with columns draped with swags, etc., instead of the former prevailing motifs taken entirely from the vegetable kingdom. The closets obtain two doors, the dressoirs become a buffet, carved friezes take on scenes of native human life instead of panel work. The "court" cupboards and buffets in this style are magnificent in their rich ornamentation and are the admiration of connoisseurs. Large armoires are often on eight legs. The table, which had evolved the trestles at each end into heavy, carved supports in the form of eagles, chimeras, lions, mermaids and satyrs, now took on revolutionary forms. And we get legged side-tables, folding tables, telescope ("drawing") tables, even dumbwaiters. Besides carved work inlays were becoming a decorative method, and before the 17th century the Flemish cabinetmakers were equalling if not excelling the Italian, German and other nations in this art. Noted Flemish Renaissance talent is found in the genius of Lucas Faydherbe, the Verbruggens and Albert Bruhl. The wonderful chimneypiece at Bruges from the designs of Lancelot Blondel and Guyot de Beauregrant, with its armorial bearings, armorini and floral detail, was carried out by the carvers, Herman Glosencamp, André Rash and Roger de Smet. With the rapid advance of the artisan in inlay work by the 17th century came also the closer commercial relations of the Dutch with the Indies and the consequent importation of exotic woods. The veneered marquetry which the Flanders woodworker had evolved from the thick inlaid Italian *intarsia* created a mighty influence. Flat surfaces gained an artistic treatment never before dreamed of. Large heavy wardrobes now came into being, often with columns at each side and in the centre, with rich square panels in the doors, their centres carved and framed in fine moldings. Philip and Theodore Galle belong to the second half of the Renaissance. The form and decoration are becoming more severe. The salient parts are held in restraint; columns begin to lose their

high reliefs of figures and appear fluted or grooved. Beds are so high steps are needed, and the bedstead comes out into the room, the canopy now resting on the carved or channeled posts. The posts are often of a style termed "distaff" (*quenouille*) like the French; or "lance" form. There are now regular dining tables, writing tables, card tables, chair tables, bench tables (*tables à banc*), round, square and oval tables, tables standing on one leg, on two and on three legs. They are made of walnut, oak, maple, cedar, cypress, marble and some even of silver. Their decoration consists of beautiful carving, mosaic work, marquetry and some are embellished with gold. The richly carved chairs often have spiral turned legs as well as the old *baluster* form with bulbed feet; seats and backs are padded with stamped leather, velvet, silk or woolen fabrics, tassels border the seat coverings and large-headed nails add to the decorative appearance. Connecting rails (*stretchers*) are placed near the ground. It was the age of Rubens, and he well defines in his paintings the furniture pieces in vogue. A peculiar style of ornamentation was the curved embossing exactly representing the human ear; it was termed *genre auriculaire*. The chair with caned back and front is said to have had its birth in Flanders. But the grandest and most prized piece of furniture of the Netherlands was the cabinet. Numismatics was the rage and the coins and medals found repose in this unique *chef-d'œuvre;* it is the *Kunstschrank* of the Germans. The usual form consisted of two parts, the upper being of smaller dimensions than the lower and being also set back somewhat. Its construction was on architectural lines, and was surmounted by a pediment, usually the "broken" style with a carved figure standing in the open space. Originally the cabinet for curios was placed on a support (often of eight legs) or table; the lower section was now closed in and had two panels as had the upper half. Lovely classical figures were carved on these panels; the subjects were frequently Neptune (for corals were one of the curio collectors' hobbies), also the Muses, Apollo, etc. The elaborate inlay decoration was truly lavish and of several varieties. Some had the Italian *pietra dura* or mosaic of encrusted stones, also amber, enamel work, even Venetian glass. The marquetry work is heightened with small pieces of ivory and mother-of-pearl. Ebony was used to enrich the finest pieces of this period, in fact some pieces were constructed entirely of ebony. Beautiful work was done by Hugues Goltz (Goltius). So renowned were the productions of the Flemish artisans that the French court sent cabinetmakers to learn this ebony and marquetry technique. On their return they were called *ébénistes,* and the term has lasted to this day for the French cabinetmaker. Artus Quellin did fine decoration, and some of his pieces are still extant; Crispin van den Passe designed much furniture. But the day of decadence brought with it poorer work in the marquetry, lacking finish and delicacy of coloring; the veneers ranged from crude to gaudy. Early in the 19th century the School of Woodcarving still kept up the art to an excellence not equalled in other European centres, and Antwerp, Brussels, Liège and other Flemish centres maintained their precedence in woodcarving.

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DUTCH GOLD. See COPPER.

DUTCH GUIANA. See GUIANA.

DUTCH HARBOR, Alaska, a port in the northeastern part of the island of Unalaska, situated on Bering Sea. It is a port of call for steamers passing through the Unimak Pass. See ALASKA.

DUTCH LANGUAGE AND LITERATURE. See NETHERLANDS.

DUTCH LIQUID, an oily liquid, insoluble in water, known to the chemist as ethylene dichloride ($C_2H_4Cl_2$). It may be obtained by the action of chlorine gas upon ethylene, and also as a by-product in the manufacture of chloral. It is most commonly prepared by passing ethylene into a warm mixture composed of 2 parts manganese dioxide, 3 parts sodium chloride, 4 parts water and 5 parts sulphuric acid. When the mass has become yellow in color it is distilled. It has anæsthetic properties, and is reputed to be quite safe, but it is irritating to the throat and is therefore not used. The name relates to its early preparation by the Dutch chemists.

DUTCH METAL. See COPPER.

DUTCH OVEN, a spider, skillet or camp-oven used by those who cook by hot coals on the hearth, a mode yet common in the Western States of the Union, and unsurpassed in its results with skilful housewives. The pot stands in hot embers, and more of the same are piled on the dish-shaped lid. The phrase is also applied to a cooking-chamber suspended in front of a fire so as to cook by radiation.

DUTCH PINK, a yellow lake, prepared from bark of the quercitron (the dyer's oak), used in distemper, for staining paper-hangings and for other ordinary purposes.

DUTCH REFORMED CHURCH. See REFORMED CHURCH IN AMERICA.

DUTCH RUSH, a common name for the scouring rush or shave grass (*Equisetum hyemale*), a plant of the horsetail family, used for scrubbing floors in country places, and imported from Holland as an article of commerce, to be used in polishing hard woods and alabaster. The stems are filled with silica deposited in a regular manner, forming an integral part of the plant. It is native throughout Europe Asia and nearly the whole of North America, where it is found in wet places and along the banks of streams. See EQUISETUM.

DUTCH SCHOOL. See PAINTING.

DUTCH SCHOOL OF FORTIFICATIONS. See FORTIFICATIONS.

DUTCH WEST INDIA COMPANY, The, an association of merchants of Amsterdam,

Zealand, the Meuse, North Holland and Friesland, incorporated 1621, with a capital of 6,000,000 florins (about $2,500,000). Unlike the East India Company, which was primarily a trading association and in its conquests and colonies had no other purpose than to protect its commerce, the West India Company never had an extensive trade, but strove to injure the Spaniards, to conquer their establishments, to capture their ships and to break the intercourse between Spain and its American gold and silver mines. The design was conceived in the interest of the Belgians, when Spanish persecutions had driven more than 100,000 Protestant families from Belgium to the north. It was thought that the Spaniards would be compelled to evacuate Belgium when their resources had been thus destroyed. Large fleets were sent out, the company possessing sometimes as many as 70 armed vessels. The prizes captured were of such value that during several years shareholders received 25 to 75 per cent interest. Twelve millions were added to the original capital. Spain and Portugal being united at this time (the union lasting from 1580 to 1640), the company not only captured the Spanish silver fleet in 1628, securing a booty of more than 14,000,000 florins, but took Bahia (1624) and Pernambuco (1630) in the Portuguese colony of Brazil. The history of Dutch Brazil had a brilliant period (1636–42) under the administration of Count John Maurice of Nassau. Curaçao was taken about this time and the company's North American colony of New Netherlands grew more and more prosperous. But the fatal defect of the company's plan now became apparent. Not being supported by extensive trade, the military and naval triumphs cost much more money than they produced. The financial condition of the company showed, after 1630, a terribly constant downward tendency; the government of Holland, moreover, was very slack in fulfilling its pledges of assistance. The beginning of the end was reached in 1641 when Portugal, having shaken off the Spanish yoke, devised means to regain Brazil. In 1654 the Dutch troops withdrew from that part of South America. The deathblow was struck when New Netherlands, the last valuable possession of the practically bankrupt company, was conquered by the English (1664). Consult Asher's 'Bibliography of New Netherlands and the Dutch West India Company' (Amsterdam 1856–67).

DUTCH WEST INDIES, The. The possessions of Holland in the West Indies are Surinam or Dutch Guiana and the colony of Curaçao. Surinam is situated on the north coast of South America between 2 and 6° north latitude and 53° 50″ and 58° 20″ west longitude, and is bounded on the north by the Atlantic Ocean, on the east by the river Merowijne (which separates it from French Guiana), on the west by the river Corantyn (which separates it from British Guiana) and on the south by inaccessible forests and savannas to the Turnac-Humac Mountains. In 1667 Surinam was assured to the Netherlands in the exchange for the colony of New Netherlands in North America. Since then it has been twice in the power of England (1799–1802 and 1804–16). Its area is 46,060 square miles and the population (1915) 85,536, exclusive of negroes living in the forests. The superior administration is in the hands of a governor, assisted by a council of four members, all nominated by the queen. The Colonial States form the representative body of the colony; the members are chosen for six years by electors in proportion of one in 200 electors. There is entire religious liberty. At the end of 1915 there were Reformed and Lutheran, 10,157; Moravian Brethren, 26,136; Roman Catholic, 18,761; Jews, 882; Mohammedans, 11,559; Hindus, 17,633, etc. There were in 1915, 28 public schools with 3,679 pupils, and 40 private schools with 6,702 pupils. There is a government normal school. In 1915 sugar was produced to the amount of 14,747,100 kilograms, cacao 1,464,200 kilograms, coffee 609,700 kilograms, rice 5,280,200 kilograms, maize 1,867,900 kilograms. Rum and molasses were produced to the extent of 1,693,500 and 112,000 litres, respectively.

In 1915 the export of gold, mostly alluvial, was 1,157,031 grammes. In this same year there entered 246 vessels of 209,418 tons and cleared 244 ships of 209,911 tons. Surinam is divided into 13 districts. Communication between these several districts is carried on by vessels and small steamers. Capital, Paramaribo (35,530).

The colony of Curaçao consists of the following islands: Curaçao (area 210 square miles, pop. 33,675); Bonaire (area 95 square miles, pop. 6,592); Aruba (area 69 square miles, pop. 9,204); Saint Martin (southern part only, area 17 square miles, pop. 3,202); Saint Eustache (area 7 square miles, pop. 1,431); Saba (area 5 square miles, pop. 2,488), a total area of 403 square miles with a population on 31 Dec. 1915 of 56,754. The capital of Curaçao is Willemstadt (pop. 11,000), which has one of the best harbors in the West Indies. There is a governor, assisted by a council of four members, nominated by the queen. The different islands, except Curacao, are under officials called "gezaghebbers," nominated by the queen. The chief products are maize, beans, pulse, cattle, salt, phosphate of lime. The most important source of income is the shipping industry, which gives employment to numerous laborers in the work of transshipping goods and as sailors on the vessels that touch regularly at Willemstadt. No statistics are available as to the amount of money thus placed in circulation. The making of straw hats continues to be the industry second in importance. The exports of straw hats to the United States in 1916 was valued at $129,034. An oil refinery was established in 1916 for the refining of crude petroleum from the Venezuelan oil fields. In 1916 the exports were valued at $967,336 and the imports at $2,461,528. The revenue is derived from import, export and excise duties, taxes on land and some indirect taxes.

In 1916 the Dutch government sent a specialist to Curaçao to investigate the sanitary conditions on the island. As a result a department of public health was established under the direction of a Dutch pathologist, and this has rendered important service in cleaning streets, wiping out mosquitoes and in the prevention of venereal disease by building a hospital for their treatment. Measures have been taken for the opening of a bacteriological laboratory and for the passage of quarantine laws suited to the climate. A modern sanatorium was completed in 1917.

DUTCHMAN, The Flying, a phantom ship which sailors believed could often be seen

about the Cape of Good Hope. The story is that a Dutch captain, Vanderdecken by name, being tossed about by adverse winds while trying to double the Cape, swore with many oaths that he would accomplish his purpose if he beat to and fro till the judgment day, and as a punishment his ship never touched land. Another version of the legend is that the Flying Dutchman is condemned to wander the seas forever because a murder was committed on board his ship.

DUTCHMAN'S PIPE, a common name for *Aristolochia macrophylla,* a plant of the birthwort family (*Aristolochiaceæ*). It has a twining stem with very slender branches, the leaves broad and thin. The calyx tube is bent in such a manner that the flower suggests a pipe with a long stem. It grows in woods from southern Pennsylvania to Minnesota, Kansas and Georgia. See ARISTOLOCHIA.

DUTT, doot, **Michael Madhusudan,** Indian poet: b. 25 Jan. 1824 at Sagandari, in the district of Jessore, Bengal, India; d. 29 June 1873. His father, Rajnarayan Dutt, was a lawyer in Calcutta. From his earliest boyhood Madhusudan showed signs of future greatness. He received his education in the Hindu College of Calcutta. His teachers always spoke highly of his scholarship. Young Dutt refused to marry according to his father's wishes and had to leave home; he renounced the faith of his forefathers and embraced Christianity on 9 Feb. 1843. After his conversion he studied in Bishops' College, Calcutta, and learned Latin, Greek, French and other languages. The study of the different literatures of the world inspired him to take up a literary career. He moved to Madras in 1848 and began to write verses in English. He married a French woman, but they were separated not long after. He then married the daughter of an English educator and this marriage proved a happy union. The couple returned to Calcutta in 1856. Dutt then realized that if he sought lasting distinction in poetry he should write in Bengali. So he began writing in Bengali in Calcutta and his first works, the 'Krishna Kumari,' 'Sarmista,' etc., were published between 1858 and 1861. The books were well received by the critics. As a great lover of Dante and Milton, Dutt wanted to introduce blank verse into Bengali poetry. His first book in blank verse was 'Yilottama Kabya.' He then brought out his masterpiece, 'Meghnad-Badha Kabya,' which has immortalized him as one of the master poets, not only of India but of the world. The story was taken from the Ramayana and the book was published in 1861. In 1862 Dutt went to England and studied for the bar. On his return to Calcutta in 1867 he began to practise law in the Calcutta High Court, but did not win success in his profession. Financial difficulties broke his health, and in extreme poverty Dutt, the greatest poet of Bengal, died in a charitable hospital at Alipur. After the award of the Nobel Prize to Rabindranath Tagore in 1913 a leading Bengali magazine took a vote as to which was the best book of poetry in Bengali and 'Meghnad-Badha Kabya' ('The Epic of the Death of Meghnad') won the first place.

DUTT, Romesh Chunder, East Indian scholar, civil servant and politician: b. Calcutta, 13 Aug. 1848. He was educated at Presidency College, Calcutta, and University College, London, at which latter institution he became lecturer on Indian history. He joined the Indian civil service in 1871, becoming a divisional commissioner in 1894, the first native of India to attain that position. In 1892 he was decorated for ability as an administrator and his literary researches. Beside a series of novels in Bengali and translations of the 'Rig Veda,' etc., into Bengali, he has published in English 'Civilization in Ancient India'; 'Lays of Ancient India'; 'Mahabharata,' condensed into English verse; 'Ramayana,' condensed into English verse; 'England and India, 1875–85'; 'Famines in India' (London 1900); 'Economic History of British India'; 'Lake of Palms,' a translation from his early Indian novel and an interesting story of Indian domestic life (London 1902).

DUTT, Toru, Hindu poetess: b. 1856; d. 1877. She received a good European education and translated into English many French poems — from Béranger, Gautier, Coppée, etc. A collection of these was published as 'A Sheaf Gleaned in French Fields' (1876). She also rendered into English some of the 'Ancient Ballads of Hindustan.' She wrote a story in French, 'Miss d'Arvers' Diary.' Consult Gosse, E. W., 'Critical Kitkats' (1896).

DUTTEEAH, doot'tē-ä, **DATTIYA** or **DATIA,** India, city, capital of a state of the same name, in the Bundelkhand Agency, central India, on the route from Agra to Saugor, 110 miles southeast of Agra. It stands on a rocky height surrounded by a stone wall and is well built, with an unusual number of stone houses. The chief of the Datia State dwells here. West of the town rises a palace of immense size and remarkable beauty, one of the best pieces of Hindu architecture in India. It is situated within a pleasure ground of about 10 acres, enclosed by a lofty wall, with embattled towers at each of its four corners. Four miles distant there are interesting Jain temples. Pop. 17,329.

DUTTON, Clarence Edward, American soldier and geologist: b. Wallingford, Conn., 15 May 1841; d. 1912. He was graduated at Yale in 1860, and two years afterward became captain of the 21st Connecticut Volunteers. He received a commission as second lieutenant in the United States army in 1863, was promoted to the rank of major in 1890. In 1875 he joined Maj. J. W. Powell in the United States survey of the Rocky Mountain region; in 1879–80 was secretary of the United States land system committee, and from 1880 to 1891 was a member of the United States Geological Survey. He was elected a member of the National Academy of Sciences in 1884, for which he made a thorough study of the Charleston earthquake of 1886. His report interpreting the results of his study were significant and stimulated a widespread scientific interest in the earthquake phenomena. His research also led him to important discoveries concerning the nature and speed of earthquake motion, and of the means of measuring the depths of the focus. (See ISOSTASY). His writings embrace the subjects of metallurgy, gunnery and geology, to which last he has devoted his main literary attention. His most

important geologic works are 'Geology of the High Plateaus of Utah' (1880); 'Tertiary History of the Grand Cañon District' (1882); 'Hawaiian Volcanoes' (1884); 'Mount Taylor and the Zuni Plateau' (1886); 'Earthquakes in the Light of the New Seismology' (1904).

DUTTON, Edward Payson, American publisher: b. Keene, N. H., 4 Jan. 1831. He was educated at the Boston Latin School, was a member of Ide and Dutton, booksellers of Boston, 1852–58, bought out Ide's interest and continued as E. P. Dutton and Company. He bought the retail business of Ticknor and Field in 1864, and also that of the General Protestant Episcopal Sunday School Union and Church Book Society of New York, and in 1869 moved the business to New York. One of the firm's notable enterprises has been the 'Everyman's Library,' an important series of inexpensive reprinted classics in all departments of literature.

DUTTON, Henry, American jurist: b. Plymouth, Conn., 12 Feb. 1796; d. New Haven, Conn., 12 April 1869. He was graduated at Yale in 1818, and became professor of law in the same university in 1847, occupying this position for eight years, and in 1854 was elected governor of Connecticut. He was judge of the Superior Court, and Court of Errors 1861–66, and prepared many digests and compilations of State statutes, which are of permanent value to his profession.

DUTTON, Samuel Train, American educator: b. Hillsboro, N. H., 16 Oct. 1849. He was graduated at Yale in 1873 (A.M. 1900). He was in charge of schools of South Norwalk, Conn., 1873–78; principal of Eaton School, New Haven, 1878–82; superintendent schools of New Haven, Conn., 1882–90; Brookline, Mass., 1890–1900; professor of education and administration and superintendent Teachers' College schools, 1900–15; professor emeritus of Teachers' College since 1915; lecturer in pedagogy, Harvard, 1895, 1896, 1897; exchange lecturer in Sweden, Norway and Denmark, 1910; chairman of the executive committee of First National Arbitration and Peace Congress, New York 1907; honorary secretary of the New York Peace Society; honorary secretary Japan Society; director of the Congregational Board of Home Missions; member (1913) of the International Commission to Investigate the Balkan Wars; member of the Council Berne Bureau of International Peace; member of the Authors and Yale clubs, New York, Sociological Association, Institute of Social Sciences, etc. He has written 'Social Phases of Education'; 'School Management'; edited 'Historical Series'; 'World at Work Readers' (1906), and is associate editor of *Christian Work*.

DUTY. A course of conduct is a duty if abstention from it is evil. This definition would seem to make duty logically dependent on good and evil, but it is possible to define the good as that which it is one's duty to secure, so that the logical order of the notion of duty and of that of good and evil is not clear. The question as to which of the two definitions represents the real order of priority between duty and good or evil has played a considerable part in ethical discussions. The question may be formulated as follows: are ethical values inherent in things and courses of conduct, without reference to any moral agent — in which case good and evil are prior to duty — or do they consist essentially in the obligations of some individual? Greek philosophy, always realistic in the scholastic sense, displayed its hypostatic tendency in ethics as well as in metaphysics, and made good and evil more or less of the nature of independent entities. Thus for Plato, the basis of morality — the Idea of the Good — is not merely a real entity but the most real of all entities. An objective good of this sort must be free from all dependence on an individual. The Greek ethics, therefore, was an ethics of duty rather than ethics of good. The ethics of the Stoics first brought into any prominence at all the notion of duty: the Stoic good, though not dependent on its relation to an agent, was a course of conduct to be pursued by an agent, so that it was at the same time a duty.

The Greek systems of ethics, as has been said, laid the greatest emphasis on the actual results intended and attained by conduct in making their evaluations. Christianity, on the other hand, made the motive of a deed the most significant factor in the determination of its worth. The good deed, according to Christianity, is that which is done in obedience to God. This obedience constitutes duty, which is thus prior to the good. The original priority of duty has exhibited a continual tendency to lapse and disappear, and moralists of the type of Paley have attempted to point out various objective goods, the attainment of which furnishes an excuse for duty. However, with the philosophy of Kant, duty came into its own again. Kant based his entire ethics on the categorical imperative. The categorical imperative is the injunction "to act only on the maxim whereby thou canst at the same time will that it should become a universal law." This is a principle of duty, and good and evil are merely adjectives applied to conduct that conforms or does not conform to the maxim.

The problem whether duty is prior to good and evil, or vice-versa, is in many respects parallel to the dispute between realism and idealism in epistemology. Just as realism claims the existence of reals apart from their relation to a percipient, the ethics of good and evil claim the existence of goods apart from their relation to an agent. Idealism and the ethics of duty correspond in a similar manner. It is a familiar fact that the difficulty of realism lies in the demonstration of unperceived reals, without involving the absurdity of a being that perceives them. In the same way, as it is difficult to pass moral judgments without putting oneself in the position of at least a hypothetical agent, the issue between the two types of ethics is not easy of decision. However, owing to this fact that we can scarcely pass a moral judgment without feeling ourselves as one of the actors in the situation concerned, we shall miss very little of importance by adopting for purposes of argument the view that duty is prior to the good, and we shall be able to give full consideration to any possible way in which the agent is actually involved in the fundamental questions of ethics. Duty thus gains at least a pragmatic priority.

In accordance with the evolutionistic trend of modern ethics, Herbert Spencer traced duty to fear of revenge, etc. There is no doubt that the experiences of one who acts from duty have a certain measure of resemblance to those of one who acts from fear. However, the two experiences, notwithstanding their qualitative similarity, occupy different places in the life of the individual. Kant expresses this difference by contrasting the universality of the claims of duty with the manyness and partiality of the inclinations, which manifestly include such aversions as fear. Whether we go as far as Kant does, and regard duty as that motive to conduct which impels us to act in accordance with laws which we consider and will as universal, we shall undoubtedly be right if we insist that the obedience of duty leads us into, not a chaotic assemblage of different deeds, but a more or less unified course of behavior.

The manifoldness of the experiences of those who act from duty is familiar to all. One man does his duty gladly, another reluctantly. On the battle-field, one may act as a soldier though in utter fear of his tasks, while his comrade is inspired by religious emotions, and still a third is enraged at the misdeeds of the enemy. In short, it is hard to find any common factor in the consciousness of duty at different times, except in the mere fact that these consciousnesses lead to a definite course of conduct. All that can be said so far of duty, then, is that it consists of a group of experiences impelling to action, and in general having fruition in acting — for even the worst scoundrel neglects a thousand opportunities to do an evil deed for every one he uses — which tend toward a unified scheme of conduct. This alone, however, is enough to show that the consciousness of duty is a harmonization and, as it were, a codification, of our various impelling, approving experiences into a workable form. Whether it is anything more, and whether duty itself is prior to the consciousness of it, are issues too wide to be discussed here, but it may be said that this psychological definition of duty and of the consciousness of it is alone sufficient to furnish duty with most of the properties usually regarded as its associates. See ETHICS, and consult the bibliography of that article.

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DUTY (customary taxes; in the constitutional struggles of mediæval England, so claimed by the sovereigns as of ancient usage and allowance), a tax or impost levied on the exports and imports of a state or district. Apparently, they were at first port fees for the use of the government quays, warehouses, weights and measures, etc.; but in very ancient times they became a general source of revenue, and used for sumptuary purposes. The constitutional prohibition of export duties leaves it applicable in the United States to imports alone. Few countries now levy a tax on exports and such a source of revenue no longer holds a place of importance in the fiscal systems of modern nations. The South American states levy some duties on exports, such as that on shipments of nitrate from Chile and that on exports of coffee from Brazil; and in 1901 Great Britain imposed a tax of one shilling per ton on all coal exported. But, generally speaking, the term customs duties means duties on imports. In countries of developed commerce these have always been the favorite means of taxation with governments and subjects alike, by a rare and significant harmony. The latter prefer them to direct taxes, as distributing the burden in small unperceived amounts on their daily income, in place of a few severe annual exactions. The former prefer them as making it possible not only to raise a far greater revenue with far less criticism, but actually to win popularity by increasing the burden, in most countries — a unique feature in administrative policy. Direct taxes have been the fertile parent of rebellions; customs duties have generally been popular in proportion to their magnitude. The latter fact is due to two other traits inherent in import taxes; that they furnish an apparent means of transferring the tax burden largely to the foreign producers, and of giving the native producer the monopoly of the "home market." It is obvious that the two are more or less self-contradictory — that the foreigner can share the payment only in proportion to his share of the market, and that if imports were annihilated all taxes would be direct; but the discussion of this subject belongs to the question of protective tariffs (see PROTECTION; also FREE TRADE; GREAT BRITAIN — THE FREE TRADE MOVEMENT and THE TARIFF REFORM MOVEMENT). Here it need only be said that it is not necessary for dutiable articles to be such as are produced within a country, for a tax to be "protective" in action: they may be high-grade articles needed in manufacturing, the charge upon which forces a resort to inferior native materials, or increase the price of the better goods. This increase is always much greater than the duty, as it includes interest on the extra capital needed to carry on business with the costlier articles, and a further charge for the restricted market due to heightened price.

Customs duties must belong to one of two classes: those charged on given units of weight or measure, as the pound, ton, yard, gallon, etc., called specific duties; and those charged by a percentage on the estimated value, called ad valorem duties. On many kinds of goods the two are combined in what are called compound duties; and a variant of the ad valorem system is what is called the minimum duty, under which all goods costing less than a certain sum are assumed to have cost that amount and are taxed upon it. In the old English disputes between king and Parliament specific duties were called "tonnage" (so much per ton); and ad valorem duties "poundage" (such a per cent on the estimated value in pounds sterling), though levied so as not to be purely ad valorem.

The merits of the two systems are not unanimously agreed upon; indeed, each has its special demerits and disadvantages, which are grave from the standpoint of national welfare. It is fair to say, however, that most of the difficulty of the specific duty lies in the attempt to use it for protective purposes, and that of the ad valorem duty in its enormous volume; that a specific duty for revenue only loses most of its objectionable features if levied on the proper articles, and that a low ad valorem duty would

be free from most of the objections of a high one. This will be evident from a glance at each.

Specific duties are simple to calculate, easy to collect, do not require a high grade of official skill and leave few loopholes for fraud. The great drawback is that they produce immense inequality of duty from the variation in cost and quality, and that inequality in exactly the wrong direction. That is, a certain number of cents on a pound or yard of cheap material may be very high or even prohibitory, while on expensive material the same may be trivial. Specific duties have an advantage over ad valorem duties in that they can be more suitably applied to raw materials and manufactures of a simple character, where there is uniformity of quality and where few opportunities are presented for fraudulent entries of goods. Hence they are applied to customs taxes on cattle, iron and steel products, minerals, flax, hemp, wool, lumber, grain, sugar, spirits, wines and tobacco. Whenever the tariff is revised attempts are made to extend the list of specific duties and at times even the Democrats have favored such duties as a check to undervaluation — as in 1857, when President Buchanan expressed dissatisfaction with the exclusive use of the ad valorem rates of the Walker tariff of 1846, since they permitted a large amount of fraud by undervaluation. In order to adjust specific duties to value some tariffs have incorporated a scale of rates, based upon value, which practically amounts to an ad valorem rate. Section 131 of the Payne-Aldrich tariff of 1909 provided a scale of duties on certain kinds of steel products as follows:

Valued at ½ cents or less per lb., 7/40 of 1 cent per lb.
Valued at ½ to 1.3 cents per lb. 0.3 of 1 cent per lb.
Valued at 1.3 to 1.8 cents per lb. 0.5 of 1 cent per lb.
Valued at 1.8 to 2.2 cents per lb. 0.6 of 1 cent per lb.
Valued at 2.2 to 3.0 cents per lb. 0.8 of 1 cent per lb.
Valued at 3.0 to 4.0 cents per lb. 1.1 of 1 cent per lb.
Valued at 4 to 7 cents per lb. 1.2 of 1 cent per lb.
Valued at 7 to 10 cents per lb. 1.9 of 1 cent per lb.
Valued at 10 to 13 cents per lb. 2.3 of 1 cent per lb.
Valued at 13 to 16 cents per lb. 2.7 of 1 cent per lb.
Valued at 16 to 24 cents per lb. 4.6 of 1 cent per lb.
Valued at 24 to 32 cents per lb. 6 cents per lb.
Valued at 32 to 40 cents per lb. 7 cents per lb.
Valued at above 40 cents per lb. 20 per cent ad valorem.

Ad valorem duties, theoretically the fairest of all, are full of practical difficulties as a revenue producer and highly unsatisfactory as a protective system, because such duties are levied according to the value of the imported commodities, instead of the weight, bulk or other unit of measurement of the commodity. In the former line the difficulties of fixing the value, the opportunities for fraud and undervaluation, the temptation to officials to connive and the expensive skilled officials needed to work it, all stand in the way of its usefulness to the government. The value is usually fixed at the point of export; but that involves minute knowledge by the official of a vast number of trades and manufactures and the fluctuations of trade conditions; and moreover, the market may have changed materially from the time the duty is assessed to the time the importer pays it, which shifts the burden from the government to the merchant. Furthermore, the plenary powers assumed by the government to throw all the burden of doubt on the importer, to seize his goods on suspicion and confiscate them on proof satisfactory to itself, but not to him, though partially remediable by the courts, and very likely necessary to secure the government, place the importer in a situation by no means free from peril. And the tedious, costly and vexatious red tape of invoicing and appraising and satisfaction of legal forms are bad at best, even if necessary; and when reinforced by the zeal of officials anxious to win laurels by harassing importers, and desirous of throwing difficulties in the way of even legitimate trade, make it impossible for small capitalists to bear the risks. Thus the small merchant is driven out of the business and the trade concentrates in a few great houses. Under ad valorem rates protection is not assured to home producers since when a decline of prices occurs a corresponding drop of duties takes place, and when he most needs it the producer cannot obtain protection. The Constitution provides that "no preference shall be given by any regulation of commerce or revenue to the ports of one State over those of another" and hence some argue that ad valorem duties do not conform to this requirement because preferences are inevitable under such duties. Protectionists claim also that frauds through undervaluation are more prevalent under ad valorem rates than under specific duties and therefore the objects of a tariff bill are defeated. The statements of importers, even though made under oath, are not regarded as final evidence of the value of goods imported, which only tends to complicate the efforts to ascertain correct values, and therefore a complex and expensive system of obtaining information of valuations is necessary under tariffs containing ad valorem rates only. The Walker tariff of 1846 contained ad valorem rates exclusively and though in some instances the duties were as high as 75 per cent and the average 25 per cent, protectionists refer to this as a free trade tariff because specific duties were excluded. Many specific duties were restored by the Morrill tariff of 1861 and retained for many years, and while an effort was made in the House to restore ad valorem duties in the Gorman-Wilson tariff of 1894, the Democratic protectionists of the Senate prevented such action. In the Underwood tariff of 1913, however, ad valorem rates were substituted for specific rates in numerous instances.

Compound duties is the term applied to the combination of specific and ad valorem duties imposed upon the same article when imported. The object of a compound duty may be twofold — to shut out cheap grades of goods by adding a specific duty to the ad valorem duty, thereby increasing the amount of taxation, or to afford compensation by additional protection where a duty is imposed upon the raw materials used in the manufacture of the article. The tariff of 1824 was the first to levy a compound or mixed duty (on certain kinds of glassware) and the tariff of 1828 imposed a duty of four cents per pound on wool and an additional 40 per cent ad valorem. In this way the tariff makers hoped to restrict the importation of the coarser grades of wool and, by handicapping the manufacturer who depended on foreign coarse grades, to place the market under the control of those Americans who manufactured the finer grades. The tariff makers placed the compensatory duty at 12 cents per pound plus an ad valorem rate designed to protect the

manufacturing industry, basing their calculations on the assumption that a pound of finished cloth required four pounds of imported wool, wherefore the duty should be four times the wool duty of three cents levied by the same act. Some later schedules levying duties on wool retained this same rate of four to one. During the Civil War period the list of commodities on which compound duties were imposed was greatly extended, so as to compensate for taxes levied on internal manufactures of the same nature, the list including iron and steel products, marble, cottons, carpets, cigars, mineral waters, soaps, perfumes, wines and liquors.

Drawbacks of duties are refunds of duties paid on goods that are re-exported; they have been provided for ever since the first tariff act of 1789. If imported raw materials are used in a finished product exported a drawback of 99 per cent of the duties paid when the raw materials were imported is allowed if the exporter of the finished product can satisfactorily identify the raw materials according to Treasury Department regulations. Drawbacks are allowed of the internal revenue duties paid on alcohol that has been used in medical or toilet preparations subsequently exported. Duties on wheat, imported from Canada, may be refunded if the flour made therefrom be exported. Drawbacks differ with the various tariff acts but the provisions are becoming more and more strict, so that the privilege is now limited to operations that can be thoroughly safeguarded.

Maximum and minimum duties is a term employed to a scale of tariff duties levied on goods imported from countries that discriminate unduly against American products. The Payne-Aldrich tariff of 23 Aug. 1909 provided that after 31 March 1910 the duties specified in the act, which constituted the minimum rates, should be increased by 25 per cent of the value of the goods imported if this merchandise came from countries unduly taxing our products in their ports. European tariffs contain such provisions, which are designed to place nations on an equal commercial footing. The McKinley tariff act of 1890 contained a similar provision but its application was more limited, since the President, by proclamation, could only levy certain duties on goods imported from certain countries which imposed unreasonable duties on certain articles of American production. Under the act of 1909 undue discrimination might have been either by tariff rates, export duty or export bounty or prohibition upon exports, and the President was given power to decide as to the existence of such unreasonable tariffs and the measure of the discrimination. There was considerable fear that the enforcement of the plan of maximum duties might incite a tariff war and that complications would creep into the schedules regularly established in the act for certain definite ends. Though no such trouble arose, or at least became serious, the plan of maximum and minimum duties contained in the act of 1909 was abolished by the Underwood tariff of 1913. See also INTERNAL REVENUE SYSTEM; STAMP TAX; TAXATION; UNITED STATES — HISTORY OF THE TARIFF.

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DUUMVIRS, dū-ŭm'vĕrs, among the ancient Romans, two magistrates, or officers, appointed for a particular purpose. They were therefore of various sorts and were specially named from the nature of their functions. The *duumviri iure dicundo* were the highest magistrates of colonies and towns, where they had the rank of consuls at Rome. The *duumviri navales* had charge of the construction and equipping and sometimes of the command, of fleets. The *duumviri quin-quennales* were the censors of municipal towns; the *duumviri sacrorum* had charge of the Sibylline books, etc.

DUVAL, dü-väl', **Alexandre,** French dramatist: b. Rennes, 6 April 1767; d. Paris, 1 Sept. 1842. He served in the French fleet during the American Revolutionary War, and on his return to France was an engineer and architect; but finally devoted himself to writing plays, of which he composed more than 60, which won great favor from their skilful construction, interesting situations and fine dialogue. He wrote the text of the very successful opera, 'Joseph in Egypt' (1807).

DUVAL, Claude, English highwayman: b. Domfront, Normandy, 1643; d. London, 21 Jan. 1670. He went to England at the Restoration, in the train of the Duke of Richmond. Taking soon to the road, he robbed many gentlemen of their purses and ladies of their hearts, till, having been captured while drunk, he was hanged at Tyburn and was buried in the central aisle of Covent Garden Church.

DUVENECK, dū'vĕn-ĕk, **Frank,** American painter and sculptor: b. Covington, Ky., 1848. He began his artistic education as pupil in the studio of Dietz, at Munich, making a specialty of portraits and genre. He formed a school there, composed mostly of Americans, whom he conducted on painting trips to Venice, Florence and other art centres. Many of his pictures are in this country, although he has lived much abroad and since 1881 has taught and painted at Florence, Italy. He was awarded a medal at the Columbian Exposition of 1893 and a special gold medal of honor at the Panama-Pacific Exposition of 1915. He was for a time director of the McMicken Art School in Cincinnati. He was one of the first to introduce the Munich style into America. His most remarkable paintings are 'A Circassian' (1875); 'Portrait of Charles Dudley Warner' (1877); 'The Professor' (1878); 'Turkish Page and Recumbent Figure' (Pennsylvania Academy); several paintings in the Cincinnati Museum; 'The Yacht Harbor' and portrait of his mother (1903). Of his sculptures the most notable is the monument to his wife in the English cemetery of Florence, Italy. He became a member of the National Academy in 1906. Consult Heermann, 'Frank Duveneck' (1918).

DUVERGIER DE HAURANNE, doo-vĕr-zhē-ā dē ō-rän, **Jean,** French theologian: b. Bayonne 1581; d. Paris, 11 Oct. 1643. At the

University of Louvain, where he studied theology, one of his fellow students, and his most intimate friend, was Cornelius Jansen (q.v.), after whom a certain system of theological views is named — "Jansenism." The two friends, after both had left the university, continued their intimate relations, first at Paris, then at Bayonne, where Duvergier had been appointed to a prebend. When Jansen left Bayonne Duvergier resigned his prebend and went back to Paris. All this time the two men had diligently been studying the ancient fathers of the Church, and in particular Saint Augustine, from whom Jansen claimed to have drawn his doctrine of Divine Grace. In Paris Duvergier's winning personality and his reputation for austere views of religious and moral obligations commended him to the favor of the bishop of Poictiers, who gave up to him the monastery, or abbey, of Saint Cyran, and there Duvergier brought together a number of devout men, formed them into a convent of monks, under the ancient, unamended rule of Saint Benedict. But his zeal for reform of the monastic life was suspected of being inspired by a secret hostility to the Church and the Church's rulers, and Duvergier was compelled to retire from Saint Cyran, whence he returned to Paris. There he was received with great favor by the highest society, especially the feminine element, and in particular he became the trusted counsellor of Angelique Arnauld, abbess of Port Royal, and all the members of the remarkable Arnauld family, those staunch defenders of Jansenism (see ARNAULD). A sect was formed and Cardinal Richelieu had strong suspicions that the abbé of Saint Cyran was leader in a conspiracy against Church and State; so he was arrested by order of the cardinal and committed to the castle of Vincennes 14 March 1638, where he was held in close confinement as long as Richelieu lived, or till December 1642; and he survived his liberation only a few months. His biography has been written by Lancelot (Cologne 1738).

DUVERGIER DE HAURANNE, Prosper, French publicist: b. Rouen, 3 Aug. 1798; d. Paris, 22 May 1881. He went to London and became in 1824 a constant contributor to the *Globe*. He was elected deputy from Sancerre, and in the National Assembly he supported Casimir-Perier and Thiers, while opposing Guizot, who had been his friend and associate on the *Globe*. After the *coup d'etat* of Napoleon III he was imprisoned for a while and eventually sentenced to banishment, but was subsequently allowed to return to Paris. He became a member of the Academy in 1870 and among the works which won him reputation is to be mentioned 'Histoire du gouvernement parlementaire en France' (10 vols., 1857–70).

DU VERNET, dü vĕr-nā', **Frederick Herbert,** Canadian bishop: b. Hemmingford, Quebec, 20 Jan. 1860. He was educated at King's College, Windsor, Toronto University and Wycliffe College. He was ordained in 1883; consecrated Anglican bishop of Caledonia, British Columbia, 30 Nov. 1904; and became archbishop and metropolitan of British Columbia, 1915.

DUVERNOY, dü-ser-nwā, **Georges Louis,** French naturalist: b. Montbéliard, 6 Aug. 1777; d. Paris, 1 March 1855. In 1802 he was invited by Cuvier, to whom he was related, to assist in editing his treatise on comparative anatomy. With the aid of the notes and counsels of his master, he prepared the last three volumes of this work, embracing the organs of digestion, respiration, circulation, generation and the secretions. In 1827 he was elected professor of the faculty of sciences at Strassburg, where, during 10 years, he published a variety of papers on anatomical subjects; and after the death of Cuvier was engaged in arranging his papers for publication. In 1837 he was elected professor of natural history in the College of France. He published numerous works, which have furnished important materials to anatomists and zoologists.

DUZINE (derived from the Dutch "dozijn"), of THE TWELVE MEN, the 12 patentees in 1677 of the Huguenot settlement on the Walkill, now in Ulster County, N. Y., and known as New Paltz (New Palatinate) from their German refuge after escaping from France. The "duzine" and their successors were the executive and legislative body of the settlement during a century.

DVINSK, or **DÜNABURG,** dü'nā-boorg, Russia, a fortified town of Russia, government of Vitebsk, on the Düna, 112 miles southeast from Riga. It was formerly the capital of Polish Livonia. It is of great military importance, being a fortress of the first class, carries on a considerable trade and is the junction of three important railway lines. Pop. (including suburbs) 110,912, of which about 30,000 are Jews.

DVOŘÁK, Antonin, ān'tōn-īn dvôr'zhāk, Bohemian composer: b. Mühlhausen, Bohemia, 8 Sept. 1841; d. Prague, Bohemia, 1 May 1904. At first intended for his father's trade of butcher, he showed such musical ability that he was sent to Zlonic to study. Here he found a friend in the village organist, A. Liehmann, who taught him elementary theory, organ and pianoforte playing. He next went to Kamnitz, where he studied under Hancke. In 1857 he entered the organ-school of the Gesellschaft der Kirchenmusik at Prague, where he worked for three years. The small financial aid he received from his father soon ceased and Dvořák found himself thrown upon his own resources. For a time he played the tenor violin in a theatre orchestra in Prague, and was also organist for several churches. In 1873 he first made himself known as a composer by a patriotic hymn for chorus and orchestra and not long afterward an opera of his, 'The King and the Collier,' was successfully produced. His first great success was his setting of the 'Stabat Mater,' first performed in England in 1883, which at once raised him to the rank of a popular and widely-known composer. Among his subsequent works are songs, operas, dances, symphonies, a wonderful cantata, 'The Spectre's Bride,' first performed at Birmingham in 1885, the composer himself acting as conductor, and an oratorio, 'Saint Ludmilla,' first performed at Leeds in 1886 under his own direction. Dvořák is characterized by a brilliant imagination, great originality and a

rare inventive power. His 'Stabat Mater,' which betrays less of the Bohemian nationality than many of his other works, is regarded as one of the greatest works of its kind in modern music. In 1892 he was called to New York as director of the National Conservatory of Music, where he remained three years. He became interested in the music of the Indians and negroes and many of the melodies of these races appear in his symphony 'From the New World,' and the overture 'In Nature.' He settled in Prague in 1895, where in 1899 he produced the opera, 'Der Teufel und die wilde Käthe.' The universities of Prague and Cambridge conferred on him the degree of doctor of music, and he was elevated to the Austrian House of Peers. He wrote five symphonies, many sacred compositions and a number of operas, which are very popular in Bohemia. He also composed several works for the pianoforte. To him we are indebted for calling our attention to the wealth of folksongs among the Slavs. Consult Hadow, W. H., 'Studies in Modern Music' (Vol. II, New York 1904); Mason, D. G., 'From Grieg to Brahms' (ib. 1902); Zubatky, 'Dvořák' (Prague 1886).

DWARF, a human being much below the ordinary size of man. Dwarfs are described by several ancient classical writers. Herodotus gives an account of a race of dwarfs living in Libya and the Syrtes, to which Aristotle and Pliny also refer. Henry M. Stanley, in his journey across Africa in 1888, came on a dwarfish race which he thought might be descended from that mentioned by Herodotus. Philetas of Cos, distinguished about 330 B.C. as a poet and grammarian, was jocularly said to have carried weights to prevent his being blown away. He was preceptor to Ptolemy Philadelphus. Julia, niece of Augustus, had a dwarf named Coropas, two feet and a hand's breadth high; and Andromeda, a freemaid of Julia's, was of the same height. The Negrilloes, occupying a belt six degrees wide in equatorial Africa the smallest known race, are supposed to have a common ancestry with the Negritoes of Asia and Melanesia. The Akkas, a diminutive race, inhabit the country west of Lake Nyanza. In 1895 a dwarf tribe was discovered on the east side of the Upper Nile. This is regarded as the most primitive race on earth, having neither laws nor rules of conduct and destitute not only of clothing but of weapons of offense and defense. In Luzon, in the Philippines, the Ætas, a pigmy race, has been discovered. Dwarfing, in races of normal size, is always a sign of stunted development and may be produced by maiming or malnutrition, by disease of the thyroid glands, rickets or spinal tuberculosis. Many dwarfs, however, are well formed in feature and physique and perfectly normal. They are as a general rule apt in intellect, but sensitive, quick-tempered and revengeful. Among dwarfs celebrated in history mention may be made of Jeffery Hudson, page to the first Duke of Buckingham. At nine years of age he was only 18 inches high. When Charles I and his queen were the guests of Buckingham, Hudson was brought to table in a pie, out of which he stepped and he was adopted by Queen Henrietta Marie. He became a captain of horse in the Civil War, and figured in two duels, one with a turkey cock and the other with one Crofts, whom, firing from horseback that he might be on a level with his antagonist, he shot dead. The best known of modern dwarfs was Charles S. Stratton, or, as he was popularly called, "Tom Thumb," who was 31 inches high at the age of 25. He was born in Bridgeport, Conn., and traveled extensively abroad and at home under the management of P. T. Barnum. Wherever he went he attracted great attention even from such personages as Queen Victoria and Napoleon III. Another modern dwarf was Francis Flynn, "Gen. Mite," who was 21 inches in height at 16 years.

In Scandinavian mythology dwarfs (*Dvergar*) are inhabitants of the interior of the earth and especially of large isolated rocks. They were imagined to be dark in aspect like the caverns in which they dwelt and were often styled "dark elves." A dwarf was set by the gods at the corner of each of the four quarters of the earth to bear up the sky; and they were named East, West, North and South. All the dwarfs were esteemed great artists in working metals and weapons of marvelous properties were said to be produced from their subterranean workshops. Like the Jotuns, they could not endure the sunlight and if its rays touched them they were turned into stone. If a man met a dwarf away from his rock and could throw steel between him and it, it was believed that thereby his habitation was closed up and that any thing in his power could be extorted from him. In the old Norse, echo is called the "dwarf language," probably because it was thought to be produced by the dwarfs within mountains imitating the sounds which they heard without.

DWARF SNAKE, a common name for small snakes of many genera, given in the United States to species of the genus *Carphiophiops,* which are found in the South in old logs. They are brown above and yellow or salmon below. The name is also applied to a pretty little snake of the genus *Haldea,* small and slender with coloring similar to the dwarf snakes of the first genus, but with a dark brown band across the head. It destroys insects and is harmless.

DWARFED TREES, a favorite ornament for dwellings among the Japanese and Chinese, who adopt a peculiar method of dwarfing. They choose some fruit- or flower-bearing branch of any tree of which they wish to produce a dwarf specimen, and cutting off a ring of the bark, surround the stripped part with clay, which they keep moist by means of a covering of moss, which is watered when it becomes dry. After a period, varying in different trees from about three months to two years, roots are sent out by the branch into the clay. The branch is then cut off below these artificial roots and planted in a poor soil, where it is kept scantily supplied with water. In this state the tree will remain for years, with vitality enough to produce leaves and even flowers annually, but never producing any but abortive shoots. Another method is to plant trees in flower pots with a shallow covering of soil, supply them, as in the former case, very sparingly with water and pinching off all the strongest shoots. Still another method, which is said to give good results when tried by amateurs, is to encircle a seed in a small

pellet of earth which is placed in the centre of a ball of absorbent moss, then is crowded into the interior of an orange from which the pulp has been removed. The moss is liberally supplied with water until the roots appear on the outside of the orange, when they are cut off and the orange-skin covered with varnish, and placed in a flower-pot. Thereafter only enough moisture is applied to support the life of the plant.

DWARKA, dwär'kä, India, maritime town of the district of Guzerat, on the Arabian Sea, on the west side of the peninsula of Kathiawar, in the dominion of Baroda, 235 miles southwest of Amedebad. On an eminence overhanging the seashore stands a great temple of Krishna, visited annually by 10,000 pilgrims. Dwarka is claimed as the birthplace of Krishna. Pop. 6,548.

DWELSHAUVERS-DERY, dvĕl'zhō'vär'-dā-rē', **Victor,** Belgian engineer: b. Dinant 1836. He received his education at the universities of Brussels and Liége and in 1869 was appointed professor of engineering at the latter seat of learning. He wrote extensively on the adjustment and regulation of machinery and on the theory of heat engines. In particular he reduced to exact figures the modern theory of steam power. He represented his government at several international expositions. His more important publications are 'Le monde ou nous vivons' (trans. by Austey 1871); 'Principes de la résistance des matériaux' (1878); 'Exposé succinct de la théorie des moteurs-à-vapeur' (1880–82); 'Etude expérimentale thermique de la machine-à-vapeur' (1892); 'Etude expérimentale calorimétrique de la machine-à-vapeur' (1894).

DWIGHT, Harrison Gray Otis, American Congregational missionary: b. Conway, Mass., 22 Nov. 1803; d. Shaftesbury, Vt., 25 Jan. 1862. He was graduated at Hamilton College, Clinton, N. Y., 1825, and became a missionary of the American Board of Commissioners for Foreign Missions in 1830, to the Armenians, making Constantinople the centre of his field of operations. He was abundant in his labors and met with great success in his work. He wrote 'Researches of Smith and Dwight in Armenia'; 'Christianity Revived in the East' (1850); and compiled a 'Catalogue of Armenian Literature in the Middle Ages' for the *Journal of the American Oriental Society.*

DWIGHT, Henry Otis, American missionary: b. Constantinople, Turkey, 3 June 1843; d. 19 June 1917. He entered Ohio Wesleyan University, but left it in 1861 to serve with the Union forces in the Civil War. In 1866–67 he was treasurer of the Northampton Street Railway Company, and in the following five years was business agent at Constantinople of the American Board of Commissioners of Foreign Missions. In 1872–79 he edited missionary publications in the Turkish language, and served also as Constantinople correspondent of the New York *Tribune* from 1875 to 1892. In 1880 he was ordained to the ministry. In 1901 he resigned his commission as missionary and soon after became connected with various missionary societies in the United States. He edited 'Report of the Ecumenical Conference on Foreign Missions' (1900), and the 'Encyclopedia of Missions' (1904). He is the author of 'Turkish Life in War Time' (1881); 'Treaty Rights of American Missionaries in Turkey' (1893); 'Constantinople and its Problems' (1901); 'Blue Book of Missions' (1905; 2d ed., 1907); 'A Moslem Sir Galahad' (2d ed., 1914).

DWIGHT, Jonathan, American physician and ornithologist: b. New York, 8 Dec. 1858. He was graduated at Harvard University in 1880 and at the College of Physicians and Surgeons of Columbia University in 1893. From 1894 to 1904 he was assistant surgeon of the department of laryngology at the Vanderbilt Clinic. After 1886 he was a Fellow of the American Ornithologists' Union and treasurer after 1905. He is a member of the American Museum of Natural History and also served as president of the Linnæan Society.

DWIGHT, Joseph, American soldier: b. Hatfield, Mass., 16 Oct. 1703; d. Great Barrington, 19 June 1765. He was graduated at Harvard University in 1722, became judge of the Court of Common Pleas of Hampshire County, Mass., and afterward of Berkshire County, and judge of probate. He was eminent both as a judge and a soldier. He commanded the Massachusetts artillery at the reduction of Louisburg in 1745 with distinction, and led a brigade at Lake Champlain in the second French War in 1756. He was also for 11 years a member of the general council of Massachusetts.

DWIGHT, Nathaniel, American educator: b. Northampton, Mass., 31 Jan. 1770; d. 11 June 1831. He was a brother of Timothy Dwight the elder (q.v.). He prepared and published the first school geography ever issued in the United States, and was also the author of 'The Great Question Answered,' and 'A Compendious History of the Signers of the Declaration of Independence.'

DWIGHT, Sereno Edwards, American Congregational clergyman: b. Greenfield Hill, Conn., 18 May 1786; d. Philadelphia, Pa., 30 Nov. 1850. He was a son of Timothy Dwight (1752–1817). He was graduated at Yale 1803 and practised law at New Haven until 1816, when he entered upon a clerical career. He preached in Park Street Church, Boston, 1817–26, and was president of Hamilton College, Clinton, N. Y., 1833–35. Among other works he published 'The Complete Writings of Jonathan Edwards with a Memoir' (10 vols., 1830).

DWIGHT, Theodore, American journalist: b. Northampton, Mass., 15 Dec. 1764; d. New York, 12 June 1846. He was a brother of Timothy Dwight, the elder. He was a well-known Federalist, a member of Congress and wrote 'History of the Hartford Convention' (of 1814), and 'Character of Thomas Jefferson.' He was editor also of the Hartford *Mirror,* the Albany *Daily Advertiser* and the New York *Daily Advertiser.*

DWIGHT, Theodore William, American educator, jurist and editor: b. Catskill, N. Y., 18 July 1822; d. Clinton, N. Y., 28 June 1892. He was educated at Hamilton College, and was professor of law there and subsequently in Columbia College, in each of which he founded a law school. He was elected (non-resident) professor of constitutional law in Cornell University in 1868, and lecturer at Amherst College in

1869. He was interested in philanthropic work, and served as president of the New York Prison Association, vice-president of the New York Board of State Commissioners of Public Charities and as a member of the "Committee of Seventy," of New York. In collaboration with E. C. Wines he published 'Prisons and Reformatories in the United States,' and was associate editor of the *American Law Register*, and editor of Maine's 'Ancient Law' (New York 1864).

DWIGHT, Timothy, American Congregational clergyman: b. Northampton, Mass., 14 May 1752; d. New Haven, Conn., 11 Jan. 1817. In 1769 he was graduated at Yale College and in 1771 became a tutor there. In 1783 he was ordained a minister at Fairfield, Conn., where he opened an academy. In 1795 he was elected president of Yale College, and he also held the professorship of theology. His chief works are 'The Conquest of Canaan,' an epic poem (1785); 'Theology Explained and Defended, in a Series of Sermons' (1818); 'Travels in New England and New York' (1821). Consult Sprague, 'Life of Timothy Dwight,' (in Spark's 'American Biography').

DWIGHT, Timothy, American clergyman and educator: b. Norwich, Conn., 16 Nov. 1828; d. New Haven, Conn., 26 May 1916. He was graduated at Yale in 1849. He stayed at Yale as tutor, studied in the theological school and was graduated there in 1853. In 1855 he was licensed to preach as a Congregationalist, but was not ordained until 1861. After studying at Berlin and Bonn he returned to Yale in 1858 as assistant professor of sacred literature and New Testament Greek in the theological seminary. Three years later, at the age of 33, he became a full professor, a position he held until his election to the presidency. Although a famous scholar his early tastes were not entirely academic. A Yale cartoon of the days when he was teaching theology pictures him studying a shot over a billiard table and saying "O, carom me back to the days of my youth." He succeeded Noah Porter as president of Yale University in 1886 and was succeeded by Arthur T. Hadley in 1899. He resigned in keeping with his belief that a president should not serve after reaching the age of 70 years. After he resigned he lived in retirement, spending his winters in New Haven and his summers in Litchfield. He assumed direction of Yale University at a time when its needs were manifold, especially as regards financial support. His great task was the securing of money for buildings and for additions to the faculty. In a particularly perplexing period he turned his own salary back into the treasury, supplied the college pulpit himself and was treasurer as well as president. In response to his efforts Yale entered an epoch of unparalleled expansion. In the 13 years of his administration the permanent funds were increased from $2,111,189 to $4,554,827 — a greater increase than in all the 185 years since Yale College was founded. President Dwight's personal contributions amounted to about $100,000. At his request the Connecticut legislature in 1887 legalized the title "Yale University." Dr. Dwight then welded the college and the professional schools into a coherent whole. His greatest work outside the campus was done when he was a member of the American committee for the revision of the Bible, from 1878 to 1885. From 1866 to 1874 he was associate editor of the *New Englander*. In 1870–71 he published a series of articles on 'The True Ideal of an American University.' He edited several volumes of the American edition of Meyer's 'Commentary on the New Testament'; translated Godet's 'Commentary on the Gospel of Saint John'; published 'Thoughts Of and For the Inner Life' (1889); and 'Memories of Yale Life and Yale Men' (1903). He received the degree of doctor of divinity from Yale and the University of Chicago and the LL.D. degree from Harvard and Princeton.

DWIGHT, William Buck, American geologist: b. Constantinople, Turkey, 22 May 1833; d. Cottage City, Mass., 29 Aug. 1906. He was graduated at Yale in 1854, at the Union Theological Seminary, New York, in 1857, and at the Yale Scientific School in 1859. He filled several educational posts in a scientific capacity, served as principal of the officers' school at West Point (1867–70), and from 1878 till his death was professor of natural history and curator of the museum at Vassar College. In 1891 he invented and patented a rock-slicing machine for the scientific section of minerals, for which he was awarded a bronze medal at the Paris Exposition of 1900. His investigations of the Cambrian and Ordovician strata and his studies of Dutchess County, N. Y., and the Wappinger Valley are extremely valuable.

DWINA, dwē'nä, **DVINA,** sometimes called **NORTHERN DWINA,** river of northern Russia, formed by the union of the Sukhona and Witchegda, in the government of Vologda. It flows in a northeastern course to the junction of the Witchegda, when it pursues a northwest course, entering Dwina Bay, an arm of the White Sea, about 25 miles below Archangel. The whole course, from the source of the Witchegda, is over 1,000 miles. Canals connect the Dwina with the Volga and the Neva. From the junction of the Witchegda to the sea is about 400 miles, all of which distance is navigable. The navaga, a kind of cod peculiar to this river, abounds in its waters.

DYAKS, dī'äks, or **DAYAKS,** the name given by the Malay invaders to the natives of Borneo. They are divided into innumerable tribes differing pretty widely in language, customs and degrees of savageness. Their traditional home was in the mountains of the interior. Physically they closely resemble the Malays, to whom they are doubtless akin, but are somewhat taller; they are intelligent, hospitable and unsuspicious, and greatly excel the Malays in truthfulness and honesty. Many of the dialects spoken by them are little known. The coast tribes have adopted many Malay words and some have completely adopted the Malay speech. Even the most uncivilized tribes have many ingenious arts and industries, weave cloth, make excellent steel weapons and erect most serviceable suspension bridges with bamboo poles and withes. Their chief weapon is the blow-pipe, not the bow. The barbarous custom of systematic head-hunting is dying out, though the heads of enemies are still cherished trophies of the warrior. See BORNEO.

DYCE, Alexander, English Shakesperian scholar: b. Edinburgh, 30 June 1798; d. London,

15 May 1869. He was educated at Exeter College, Oxford; and, taking orders, held several curacies prior to 1827, when he settled in London, where the most of his life was passed. He was first brought to notice by his 'Specimens of British Poetesses' (1825), which was followed by editions of Collins (1827), George Peele (1828), Webster (1830), Robert Greene (1831), Middleton (1840), Beaumont and Fletcher (1843–46), Marlowe (1850), Shirley (1833), Skelton (1843), Wotton and Drayton, all of which were accompanied by notes and biographies of the authors. In 1840 he founded, in conjunction with Collier, Halliwell and Wright, the Percy Society, for the publication of ancient comedies and ballads. His chief labors, however, were devoted to Shakespeare, an edition of whose works he published in 1857; second edition, greatly improved, nine volumes (1864–67). In his 'Remarks on Collier's and Knight's Editions of Shakespeare' (1844) he pointed out several errors into which the modern commentators on Shakespeare had fallen; and in another work, entitled 'A Few Notes on Shakespeare' (1853), he pronounced very strongly against the emendations of the text of Shakespeare published by Collier, and maintained by him to belong to the first half of the 17th century. His 'Glossary of Shakespeare,' which extended to 500 pages, is a standard work. His work is at once learned and scholarly, accurate, sane and luminous.

DYCE, William, Scottish painter; b. Aberdeen, 19 Sept. 1806; d. Streatham, 14 Feb. 1864. In 1830 he settled at Edinburgh, where he soon became known as a portrait-painter and as a distinguished contributor to the exhibition of the Royal Scottish Academy. In 1827 he had exhibited at the Royal Academy his 'Bacchus Nursed by the Nymphs.' About 1837 he settled in London. In 1836 he exhibited 'The Descent of Venus,' the subject of which was taken from Ben Jonson's 'Triumph of Love'; and in 1839 'Saint Dunstan separating Edwy and Elgiva.' When the decoration of the interior of the new houses of Parliament was made a subject of competition Dyce exhibited his talents in a new light, namely, as a painter in fresco. His first fresco, 'The Consecration of Archbishop Parker,' was executed in Lambeth Palace, and was followed by 'The Baptism of Ethelbert,' in the House of Lords (1846). He was elected to the Royal Academy in 1848 and was also a member of the Academy of Fine Arts of Philadelphia. In 1848 he was commissioned to paint a series of seven frescoes in the House of Lords, but he only lived to complete five. Among his other pictures are 'Joash Shooting the Arrow of Deliverance' (1844); 'Virgin and Child' (1846); 'Omnia Vanitas' (1849); 'Meeting of Jacob and Rachel' (1850); 'King Lear and the Fool in the Storm' (1851); and 'John Leading Home the Virgin' (1860). His artistic sense finds best expression in his religious pictures, and he was in full sympathy with the Pre-Raphaelite movement. Notable also is his decorative work, both as a painter and as a designer of stained glass.

DYEA, dī'ā, Alaska, a former village on Chilkoot Inlet, the east fork of Lynn Canal, which was important during the gold-rush, as being the starting-point of the Chilkoot Trail, a much traveled pathway to the valley of the Yukon and the Klondike fields. The building of the White Pass and Yukon Railroad from Skagway (q.v.) reduced Dyea to insignificance.

DYEING. Dyeing is the art of staining or coloring yarn or cloth in such a manner that the color is to a measurable degree permanent. The art was practised among the Eastern nations from time immemorial, and in the Scriptures we read of the vestments of the high priest being dyed purple and of linen cloths being dyed blue, purple and scarlet. The famous Tyrian purple is believed to have been discovered by the inhabitants of Tyre 1500 B.C., and immediately afterward Tyrian purple became the badge of royalty and cloth dyed with it commanded a very high price. The Egyptians, Grecians and Romans practised the art of dyeing and it gradually became more widespread as civilization advanced. In earlier times dyeing was much more extensively followed as a domestic art than at present. The process of dyeing is accomplished in two stages: (1) absorption; and (2) fixation. The first is a simple diffusion of the dye throughout the fibre; the second is the result of a chemical action in which the dye becomes insoluble in the material of the dye bath. Where mordants are used it is the mordant which is applied to the fibre in the absorption stage. The textile fibres upon which the dyer exercises his art are of two groups: (1) animal fibres, as wool and silk; and (2) vegetable fibres, as cotton, linen, jute, ramie and the artificial «silks.» Wool fibre is the most complex, being composed of three forms of cells. Silk has no cellular formation, being practically a long double cylinder. In cotton each fibre is a single hollow cylindrical cell, flattened and twisted. In linen and jute similar hollow cells are grouped in clusters to form the individual fibres. In chemical composition and reaction there are still wider and more significant differences.

If the various coloring matters used in dyeing had an affinity for the fibre in its natural state the process would be very simple. It would be necessary only to make a solution of the dye drug and immerse the goods to ensure their being dyed. But so far from this being the case, if we except indigo and safflower, there is scarcely a dyestuff that imparts its color directly to goods. The greater part of the dye drugs have so weak an affinity, for cotton goods especially, that they impart no color sufficiently permanent to deserve the name of a dye. The reason for this is simple. For example, in a decoction of logwood the color matter is held in solution by the water. Upon putting a quantity of cotton into this solution the fibre becomes filled with the colored solution, and if the cotton has no power to render that coloring matter insoluble within its fibres it is plain that by taking out the cotton and putting it into water the coloring matter within it will be diffused in the water. In other words, the dye having no attraction for the fibre is washed out. This lack of primary affinity makes dyeing intricate and renders it more dependent upon science. Indeed, it is only by the careful arrangement of processes in accordance with certain chemical laws that the dyer is enabled to turn to advantage the various coloring matters of which

he is in possession. When the dyer finds there is no affinity between the goods and a coloring substance he wishes to use he endeavors to find a third substance which has a mutual attraction for the fibre and coloring matter, so that by combining this substance with the fibre and then passing the cloth through the dyeing solution the coloring matter combines with the substance which is upon the goods and creates a color. This third substance used, which acts as a mediator, combining two inimical bodies, is termed a mordant.

All the mordants with one or two exceptions are found among the metallic oxides. In order that a substance may act as a mordant it must have an attraction for the coloring matter so as to form with it an insoluble colored compound, and it must be held easily in solution. It may also have an affinity for the fibre and a tendency to unite with it, but this property is not essential. The first two properties limit the mordants almost entirely to what are termed the insoluble bases, that is, substances which are not by themselves soluble in water. The bases or oxides which are in general use as mordants and which appear to succeed best are alumina and the oxides of tin, chromium and iron. An important part of all dyeing operations is the proper choice and application of mordants; there being a chemical union between them and the coloring matter a new substance is formed, not only differing in properties but differing in color from any of the originals. Consequently, a very little alteration in the strength or quality of a mordant causes a decided variation in the shade of color. As, for example, logwood alone gives no color to cotton worthy the name of a dye, yet by judicious application of a few different kinds of mordants all the shades, from a French white to a violet, from a lavender to a purple, from a blue to a lilac and from a slate to a black, are obtained from this substance. Before any chemical union takes place between bodies they must not only be in contact, but they must be reduced to their ultimate molecules. Mordants that are insoluble of themselves must be dissolved in some appropriate menstrua before their particles can enter the fibres of the goods or combine with the coloring matter. In doing this the dyer must respect the degree of affinity between the solvent and the mordant to determine what force it will exert against the combining of the mordant with the fibres of the cloth. Otherwise, a powerful mordant may be weakened by the attraction of the solvent. For example, common alum even though much concentrated is but a weak mordant for cotton goods, owing to the great attraction between the alumina and the sulphuric acid of the dye bath. But if acetic acid, which has comparatively a weak affinity for the alumina, be substituted for sulphuric acid it becomes a very powerful mordant.

It is with the vegetable coloring matters, however, that the greatest attention must be paid to the many conditions and properties of mordants. Bi-chromate of potash is largely used as a mordant for logwood and fustic for blues, blacks, browns and a variety of shades of color. Bi-chromate of potash, alum and oxalic acid as mordant on wool produce with logwood a very fine navy blue, but one that is not very fast to light. Sulphate of copper is the mordant most largely used with logwood for making black on cotton. These mordants are used almost exclusively for the wool dyes. In dyeing wool, either raw, woven or as yarn, care has to be taken that the wool is thoroughly free from grease before being mordanted. This is done by passing it through either soap, sal soda or soda ash and then thoroughly rinsing to free it from the alkali solution. If this is not done unevenness in the dyeing is caused, as well as a rubbing off of the color. When the dyer is given a shade to match he has to take into consideration the degree of fastness required, as where goods have to be heavily fulled, unless the colors are sufficiently fast, they will full out and be spoiled. In this case only such dyes can be used as will stand this process. The quantity of dye to be used depends on the class of wool to be dyed, as the finer the quality of the wool the more dyestuff it takes to produce the same shade. The dyer also has to study to produce the result at the lowest possible cost, both for labor and dyestuff. Machines are now manufactured which economize in the labor and a large quantity of goods are dyed at one time. It would be generally supposed that where the dyer carefully proportioned out his dyestuff to the weight of the material to be dyed and observed every care in reference to the mordant and heat that the shades would come out alike. However, this is not the case, and with the greatest amount of care the shades will vary and it is necessary to use extra skill after the shades get off the pattern to bring them again to the shade required. The dyer, knowing full well that owing to difference in the water and the stock in the goods, besides conditions that are not always understood, that the shade is apt to vary, begins his operation with a minimum quantity of the dyestuff and if he finds that he is not up to the shade required, he adds such dyestuff as is necessary to give the desired result. In fact, making the shade right when it is once off the pattern requires the highest skill on the part of the dyer. The dyeing of wool is the result of a chemical combination. On the other hand, the dyeing of cotton is a fixation of a colored substance in the pores of the cotton. Cotton is dyed in the raw state, pieces and yarns, and the amount of dye used to produce a given shade also varies somewhat according to the quality of the staple. In using colors requiring a mordant sumac and antimony are used, and the amount employed is governed by the depth of the shade required.

Dyeing of Mixed Fabrics.— The coloration of textile fabrics composed of more than one kind of material generally requires two or more processes, as the plan pursued in dyeing wool is seldom capable of fixing the color upon cotton. The customary plan followed is to immerse the fabric in the requisite baths to dye the wool and then to treat the partially dyed material in the manner found suitable for cotton. Occasionally the woolen thread of the cloth is dyed of one color and thereafter the cotton is treated so as to acquire a different shade or color. With some of the coal-tar colors mixed fabrics can be dyed in one bath, thus saving much time. The dyer is now able to produce by combination of different dyes a great variety of rich shades on mixed fabrics, and even to dye two shades in the same fabric by first

dyeing the wool in the hot bath with an acid dye, then cooling down his bath and adding his cotton dye and dyeing the cotton another shade from what was produced on the wool. In dyeing silk care has to be taken to free the silk from all gums, and this is done by boiling off in a soap bath. Most of the dyeing is done direct and under the boil.

In imparting deep indigo blue to woolen cloth and yarn a vat six or seven feet in diameter and eight to nine feet in depth is nearly filled with water, along with from 18 to 22 pounds of indigo finely ground in water, 10 to 20 pounds of madder, 7 to 9 pounds of bran and 9 pounds woad. After boiling and the addition of seven or eight pounds of lime to form the alkaline liquid necessary to hold the indigo solution, the whole is well closed over with tightly-fitting wooden covers. Within 24 hours the putrid fermentation of the woad and the bran abstracts the oxygen from the blue indigo until it assumes a yellowish color, and the solution then contains indigo white. If woolen cloth or yarn is now dipped in this liquid it comes out of a yellow tint from the attachment of the white indigo. But when exposed to the air the oxygen immediately begins to act on the white indigo, combining with it to form oxidized or blue indigo, and as the process of oxidation continues the yarn or cloth becomes first of a greenish and then of a blue color. If the cloth be again soaked in the yellowish solution and subsequently exposed to the air the depth of the blue color may be increased, step by step, till it arrives at that deep shade of blue so well known.

In the dyeing of cotton with indigo the vat is prepared differently. The indigo is first ground into a thin paste with water and afterward placed in a vat with protosulphate of iron and milk of lime. The lime (CaO) takes the sulphuric acid (SO_3) from the sulphate of iron ($FeOSO_3$) forming sulphate of lime ($CaOSO_3$), and liberating the protoxide of iron (FeO), which rapidly abstracts the oxygen from the blue indigo, reducing it to white indigo, and the latter dissolves in the excess of lime present in the vat, yielding a colorless solution. When cotton cloth or yarn is dipped in this it comes out of the vat almost colorless, but on exposure to the air the indigo becomes reoxidized and the cloth passes to a green and ultimately to a deep blue shade. The cloth or yarn is then washed in water and afterward soaked in a very dilute sulphuric acid to remove any oxide of iron remaining attached and rewashed in water, when the blue color becomes more bright and clear. Fast fulling colors dyed either in the wool yarns or pieces are usually dyed with the alizarine colors on account of their being fast to fulling and light. These are usually mordanted with bi-chromate of potash and cream of tartar for one and a half hours at the boiling point. Then they are thoroughly rinsed in cold water and finished in another bath with the alizarine colors. Owing to the great affinity existing between the alizarine colors and the mordanted wool, great care has to be taken to enter the bath at a low temperature and very gradually bring to the boil to ensure the goods being dyed even. Extra care must also be taken that no more alizarine is added than is necessary to produce the shade. Cotton is now largely dyed direct. Formerly dyers were obliged to give a number of baths and even then were not able, in a great many cases, to secure the brilliant shades that are now dyed in one operation. The color simply being fixed in the pores of the cotton, it is more difficult to secure a fast color on this fibre than on wool. As in the case of wool, dyeing machines are now manufactured by which the cotton is dyed both in the raw state, yarns and pieces, which economize in the labor and enable the dyer to produce better results both as to shade and fastness. During the last few years, there has been a large addition to the coal tar dyes, thus giving cotton dyers a much better opportunity to produce brighter and faster colors.

The yarns for carpets are dyed almost exclusively with the coal tar dyes. This is done direct by entering them in the dye bath, which has previously had added the color, with the proper proportion of sulphuric acid and glauber-salt and gradually brought to the boil, being turned by hand. The bath is generally exhausted in about three-quarters of an hour. The yarns as furnished to the dyer are frequently of a mixed material which is dark in color, and in this case he must choose the most brilliant of dyes to give the required brightness of shade. For the finer grades of carpets, the color must thoroughly penetrate and in matching shades the dyer usually cuts his yarn and matches from the centre.

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F. H. Prescott,
Expert in Dyes and Dyeing, Philadelphia.

DYER, dī'ẽr, **Alexander Brydie,** American soldier: b. Richmond, Va., 1817; d. 1874. He was graduated at West Point and joined the Third United States Artillery in 1837. He served in the Florida War of 1837–38 and in the war with Mexico in 1846–48, being brevetted captain for gallant conduct. During the Civil War he was appointed chief of ordnance at Washington with the rank of brigadier-general and in this office did much to increase the efficiency of the ordnance department. From 1861 to 1864 he was in charge of the Springfield (Mass.) armory and in 1865 he was brevetted major-general in the regular army.

DYER, Eliphalet, American jurist: b. Windham, Conn., 28 Sept. 1721; d. there, 13 May 1807. He was graduated at Yale College in 1740 and began law practice in 1745. During the French War of 1755 he commanded a Connecticut regiment; was elected a member of council in 1762; chosen delegate to the Stamp Act Congress in 1765 and served as a member of Congress during the War of Independence. He was judge of the Superior Court 1776–93, and chief justice for the four last years of his service there.

DYER, George, English antiquary and scholar: b. London, 15 March 1755; d. there, 2

March 1841. He was educated at Cambridge through the kindness of his friends and from 1792 till his death lived by literary work in London. He edited 'Valpy's Classics' and among other writings published a 'History of the University and Colleges of Cambridge' (1814). His great labors resulted in his total blindness. Lamb's essay 'Amicus Redivivus' gives a fine picture of the eccentric, industrious, friendly old antiquary.

DYER, Henry, Scottish educator: b. 1848. He was educated at Anderson's College and at Glasgow University. He received the appointment of first principal of the Imperial College of Engineering, Tokio, Japan, and served also as professor of civil and mechanical engineering. In addition he became director of large engineering works; remained in Japan 10 years and was appointed honorary principal of the College of Engineering on retirement and honorary member of the Institutions of Civil Engineers, Mechanical Engineers and Naval Architects, Japan. After his return to Britain he took an active part in engineering, educational and social work. He is a life governor of Glasgow and West of Scotland Technical College; a governor of the West of Scotland Agricultural College, of the Glasgow School of Art and other institutions. His publications include 'Dai Nippon: The Britain of the East'; 'Japan in World Politics'; 'The Evolution of Industry'; 'Science Teaching in Schools'; 'Education and National Life'; 'Education and Industrial Training'; 'Education and Citizenship' and numerous papers and articles on engineering, educational, literary and social subjects.

DYER, Isadore, American physician: b. Galveston, Tex., 2 Nov. 1865. He was graduated at the Sheffield Scientific School of Yale University in 1887, studied also at the University of Virginia 1887–88 and received the degree of M.D. at Tulane University in 1889. In 1890–92 he served as interne at the New York Skin and Cancer Hospital; was lecturer at the New York Post-Graduate Medical School in 1891–92. In 1892 he began his long connection with the medical department of Tulane University, becoming associate professor of diseases of the skin in 1905, professor in 1908 and dean in 1908. Since 1896 he has edited the New Orleans *Medical and Surgical Journal* and since 1913 the *American Journal of Tropical Diseases and Preventive Medicine.* In 1894 he founded the Louisiana Leper Home, of which he has been consulting leprologist since 1902. He is author of various articles in leading medical text and reference books.

DYER, John, English poet: b. Aberglasney, Carmarthenshire, Wales, 1700; d. 24 July 1758. He was originally a painter and his sense of beauty in scenery is shown in his 'Grongar Hill,' a poem published in 1727. He took holy orders in 1740 and received the living of Calthorpe, Leicestershire, in 1741, but eventually settled in Lincolnshire. He published 'Ruins of Rome' (1740) and 'The Fleece' (1757), by which latter poem he is best known.

DYER, Louis, American writer and lecturer: b. Chicago, 30 Sept. 1851; d. 20 July 1908. He was educated in early years in Chicago, Switzerland and France, was graduated at Harvard in 1874 and afterward studied at Balliol College, Oxford. He was assistant professor of Greek at Harvard (1881–87), and settled at Oxford in 1890, where he was lecturer at Balliol College (1893–96). He lectured before the principal colleges of this country and published among other works 'Studies of the Gods in Greece at Certain Sanctuaries Recently Excavated' (1891); a translation of Cossa's 'Introduction to the Study of Political Economy' (1893); 'The Greek Question and Answer' (1884); 'Oxford as it is' (1902); 'Machiavelli and the Modern State' (1904).

DYER, or DYAR, Mary, American martyr: d. Boston, 1 June 1660. She was a victim to the persecution which befell the Quakers in the early history of Massachusetts. She and her husband, William Dyer, came to Boston from London in 1635, but were forced to retire to Rhode Island in 1638. She was again in England from 1652 to 1657 where she became a convert to Quakerism. She came to New Haven in 1657, but was expelled therefrom in the following year. The government of Massachusetts by a statute excluded Quakers from the bounds of that colony and sentenced to death any one of that sect who should be guilty of a second visit there. The statute was little regarded, or rather was construed as an invitation instead of a menace by the enthusiastic and devoted believers against whom it was directed. Mary Dyer had departed from the jurisdiction of the magistrates upon the enactment of the law, but soon after returned on purpose to test its legality. She was arrested, went willingly to prison, and there wrote a remonstrance in which she denounced the injustice of the proceedings. She received sentence of death, and with a rope around her neck witnessed the execution of her friends Robinson and Stephenson, and then was banished from the colony. Seven months later she returned, and for exciting "rebellious sedition" was publicly hanged on Boston Common. Consult Jones, 'The Quakers in the American Colonies' (New York 1911); and Rogers, 'Mary Dyer, the Quaker Martyr' (Providence 1896).

DYER, Nehemiah Mayo, American naval officer: b. Provincetown, Mass., 1839; d. 27 Jan. 1910. He enlisted in the navy in 1861 and was promoted for gallantry in the Civil War, having attained the rank of volunteer lieutenant by 1865. He rose steadily through the grades to that of captain in 1897 and as commander of the protected cruiser *Baltimore* took part in the battle of Manila Bay, 1 May 1898; was promoted rear-admiral in 1901 and retired the same year. He was chairman of the commissioners of the Massachusetts Nautical Training School in 1903–04.

DYER, Thomas Henry, English historian: b. London, 4 May 1804; d. Bath, 30 Jan. 1888. He traveled and studied for years to prepare a 'History of Modern Europe' (1861–64); 'History of the City of Rome' (1865); 'Pompeii' (1867); and 'Ancient Athens' (1873), all monuments of learning and critical insight.

DYER, Sir William Turner Thistleton, English botanist: b. Westminster, London, 28 July 1843. He was educated at Oxford, and beside holding other professional posts was director of the Royal Botanic Gardens at Kew from 1885–1905. He has edited 'Flora Capen-

sis'; and 'The Flora of Tropical Africa'; and is joint author of 'The Flora of Middlesex' (1869). He was created K.C.M.G. in 1899.

DYER'S BROOM; GREENWEED WOADWAXEN. See DYEWEED.

DYER'S-MOSS, a lichen, called also archil or orchil. See ARCHIL.

DYER'S ROCKET, DYER'S WEED, or **WELD,** a plant (*Reseda luteola*), of the mignonette family (*Resedaceæ*). It is an erect herb, sparingly branched, with long, narrow spikes of greenish-yellow flowers. The plant is extensively cultivated in Europe for the beautiful yellow dye it yields, and was originally grown in American gardens for the same purpose. It now grows wild in waste places, on Long Island, and in various spots near the eastern seaboard. It is known also as woad.

DYER'S WEED. See DYER'S ROCKET.

DYERSBURG, Tenn., city, county-seat of Dyer County, on the north fork of the Deer River, navigable as far as Dyersburg; on the Illinois Central and other railroads, and about 80 miles northeast of Memphis. The neighboring country is very fertile, yielding large crops of cotton, corn and wheat. The manufacture of cotton, wagons, flour, brick, tile, staves and headings and the sawing and planing of lumber supply the chief occupations of the town. Tobacco, iron goods, machines and wooden bowls are also made here. The city owns its own electric-light and waterworks plants. Pop. 5,000.

DYES, substances employed to impart colors of a measurable degree of permanence to fabrics. They are classified according to their origin as (1) natural organic dyes — in two groups, vegetable and animal; (2) mineral dyes and (3) artificial organic dyes. The first class includes such vegetable coloring agents as indigo and logwood, and such animal dyes as cochineal. The second class includes such mineral coloring agents as chrome yellow and Prussian blue. The third class is by far the largest and most important, as it embraces the thousand and more coal-tar colors, synthetic indigo, etc. With the exception of indigo and logwood, few of the natural organic dyes are in extensive use, having been in large part superseded by coal-tar dyes of simpler application and more brilliant color. Those still in considerable use are as follows:

Annatto or **arnotto,** prepared from the fermented seed of *Bixa orellana,* a tree growing in Central America, the Antilles and the East Indies. The dye principle is known as *bixin.* It is insoluble in water but dissolves readily in alkalis. It is used on cotton direct or with a tin mordant, and gives a hue of bright orange. At present it is used chiefly in tinting butter and cheese.

Archil or **orchil** is developed by fermentation with ammonia principally from the lichens *Roccella* and *Lecanora;* the first growing in the Canary and Cape Verde islands, the East Indies, Madagascar, Central and South America; the second on the coasts of Norway and Sweden, Scotland, Ireland and Wales: The active principle is *orcein,* an alkali salt of orcin. This dye is used in large quantities for "bottoming" indigo, and in conjunction with other dyes, on silk and wool, especially for carpet yarns. The color is of great body, and includes shades of red, magenta and violet. The dye appears in the market as a thick liquid called "archil," a paste called "persis," and a brownish or purplish powder called "cudbear."

Berberine is found in the root of the barberry and several other plants. Its active principle bears the same name, and it is the only natural basic dye. It imparts a golden yellow to silk and leather, and also to cotton if mordanted.

Brazil Wood appears in the market as chips, raspings and extract, of various species of *Cæsalpinia,* natives of the West Indies, Central America, and of tropical South America, Africa and Asia. The wood yields two active dye principles, *brasilin* and *brasilein,* producing shades of pink, purple and crimson, which, however, are not fast in the laundry.

Camwood, and its allies *barwood* and *sandalwood,* yield the coloring principle *santalin,* used chiefly in conjunction with logwood and fustic for producing compound shades, especially browns, on wool. The colors obtained range from dull red to claret-brown. It is also used to give "bottom" to woolen fabrics to be dyed with indigo later.

Cochineal, as marketed, consists of the dried bodies of the females of the *coccus cacti,* an insect found in Mexico and Central America and other tropical countries living on the opuntia cactus. The "black" cochineal of commerce is produced when the insects are scalded before drying, the "silver" cochineal when they are dried in stoves without scalding. The coloring principle is carminic acid. Carmine is obtained by precipitation from the cochineal extract with acid salts. This dye is still much used for bright scarlet and crimson on wool with tin and alum mordants respectively. With chromium and iron mordants cochineal gives purple and with a copper mordant, claret shades.

Cudbear, see *Archil.*

Cutch, also known as **catechu** and **gambier,** is the dried sap of the green wood and pods of the acacia and mimosa trees, and also of the Areca palm. The gambier cutch is obtained from the leaves of the *Uncaria gambier,* and is called "cubical cutch" because it is marketed in small cubes. The coloring principles in cutch are *catechin* and catechu-tannic acid. Both are used in the production of olives and browns on cotton and infrequently on wool. Catechu-tannic acid dyes silk plush a rich seal brown, and with an iron mordant yields a fine black. It is also used as a "bottom" for some of the basic coal-tar colors.

Fustic, also known as **Cuba wood** and **yellow wood,** is obtained from the *Morus tinctoria,* a tree growing in the West Indies, Central America and tropical South America. The best quality comes from Cuba and Mexico. The wood is marketed in chips or ground, and an extract also is prepared which is sometimes reduced to a soft paste or solid form — often adulterated with glucose and quercitron. Fustic yields to two color principles, *morin* and *maclurin,* and gives bright yellow with an alum mordant, olive yellow with chrome and bright orange-yellow with tin. It is used more on wool than on cotton. At its best it is not fast

to light. Its largest use is with logwood to produce a dead black and with cutch to produce catechu shades.

Indigo is obtained by fermentative steeping of the stems and foliage of several species of the *Indigofera* family, and to a less extent of some others. Its characteristic blue color principle is *indigotin*, but indigo contains also another dye principle, *indirubin* or indigo red. It is used very extensively in dyeing both wool and cotton, and is employed also as a "bottom" for compound shades — olives, browns and blacks. Indigo extracts are produced by the action of sulphuric acid on indigo. They are, chemically, indigotin sulpho-acids, and are freely soluble in water, and dye wool with rapidity, and a brighter color than ordinary indigo; but the color fades on exposure to light.

Logwood or Campeachy wood is the product of the large and rapidly growing tree, *Hæmatoxylon Campechianum*, a native of tropical and subtropical America, Cuba, Haiti and the West Indies. The best qualities now come from Jamaica and Honduras, the Campeche (Mexico) supply being practically exhausted. Logwood is white in color when first cut, the brown-red hue being developed by exposure to the air. It is marketed in the form of a concentrated extract made from the chips or raspings after ageing and fermenting. The coloring principle is *hæmatein*. It is used in the dyeing of silk, as it renders the fibre opaque, a quality lacking in coal-tar dyes. It is employed also in the production of cheap blacks on wool and cotton. On wool it is used with a chrome mordant, producing a bluish-black, and with a tin mordant, producing a violet tone. In conjunction with other dyes it produces blues, greens, olives and browns.

Madder, as marketed, is the ground cortex of the root of the madder plant, *Rubia tinctorum*, a native of Asia Minor. It has been cultivated many years in Italy, France and Holland. It yields the dye principles, *alizarin, purpurin, pseudo-purpurin, xanthin* and *chlorogenin*. Madder is used in dyeing woolen cloth and carpet yarns, but for few other purposes. With chromium it gives bluish-red to crimson; with iron, reddish-brown to maroon; with aluminum, scarlet to pink; with copper, yellow-brown; with tin, reddish-orange.

Persian Berries are the dried fruits of several species of *Rhamnus* (buckthorn) growing wild in Asia Minor. They are also cultivated in southern Europe and the East. They yield two color principles, *rhamnetin* and *rhamnazin*. They are used chiefly in printing cotton fabrics, with aluminum mordant for bright yellow, tin mordant for orange and chromium mordant for brown. With cochineal, they produce orange and scarlet, giving redder and deeper shades than fustic or quercitron — but at increased cost.

Quercitron is the inner bark of the *Quercus tinctoria*, an oak native to America, and growing in large numbers in Pennsylvania and the South Atlantic States. It appears in commerce as the ground bark, and its extract. It contains two color principles, *quercetin* and *quercitrin*. A purified or concentrated dry extract in powdered form has the trade name of "flavine." Quercitron imparts a bright yellow to wool and mordanted cotton and silk. With cochineal it produces bright orange shades, and with logwood gives blacks. With aluminum it produces greenish yellow; with chromium, dull yellow; with tin, bright orange; and with iron, olive to greenish black.

Robinia, a new natural dyestuff, was discovered in 1915, in the Yellow Locust, *Robinia pseudacacia*. The extract is similar to that of quercitron. It is still in the experimental stage.

Safflower, the dried flower head of *Carthamus tinctoria*, cultivated in India and Egypt. Its active principle is *carthamin*, which produces shades of pink on bleached cotton. The color is not fast either to light or the laundry.

Saunders-wood or **Sandalwood**, see *Camwood*.

Turmeric or Indian Saffron, is the ground root of the *Curcuma tinctoria*, a plant growing abundantly in China and the East Indies. The coloring principle is known as *curcumin*, and dissolves out of the turmeric freely with alcohol, and less freely with hot water. It imparts yellow to cotton, wool and silk, but is used principally in combination, as its color is not fast. Although mordants are not necessary, their use produces modified shades of yellow, orange and olive.

Weld is the dried top and seeds of *Reseda luteola*, cultivated generally throughout Europe. The coloring principle is called *luteolin*. It is regarded as the best and fastest of the natural yellow dyes for silk, and is used chiefly on aluminum and tin mordants, yielding greenish yellow and bright yellow. With other mordants are secured shades of olive-yellow.

Young Fustic, the ground wood or extract of the Venetian Sumac (*Rhus cotinus*), a tree growing in southern and eastern Europe, the Levant, Jamaica, etc. The coloring principle is fisetin. Young fustic, which is not "fustic" at all, imparts shades of yellow which are so fugitive to light and the milling processes as to be seldom used.

Mineral dyes, though formerly in extensive use, have been largely displaced by the coal-tar dyes. However, they are generally very fast to light and the laundry, and being cheap are still employed to a considerable degree. Their dyeing qualities are due to the deposit of insoluble pigments in the fibres of the fabric dyed.

The few mineral colors now in use are the following:

Bistre, see *Manganese Brown*.

Chrome Yellow, chemically chromate of lead, is used on cotton only. The fabric is first impregnated with nitrate or acetate of lead, which is then changed to the oxide by ammonia, or to the sulphate by sodium sulphide. It is then passed through a weak solution of potassium bi-chromate. All the chrome colors are poisons, and they are continued in use chiefly because they weight the fabric heavily.

Chrome Orange is produced by first dyeing the fabric with chrome yellow, and then passing it through boiling dilute limewater.

Chrome Green is usually produced by first dyeing the goods with a light shade of indigo blue, and then with chrome yellow.

Khaki is produced on cotton by passing the cloth, after scouring, through a mixture of ferrous and chromic acetates and drying; then aging and passing through a boiling mixture

of caustic soda one part and carbonate of soda three parts.

Manganese Brown, or **Bistre,** is produced on cotton by impregnating the fabric with a solution of manganese chloride, and then passing it through a hot solution of caustic soda — which precipitates the manganese hydroxide in the fibre. On exposure to the air this oxidizes to a brownish hue, and the color is improved and finished by immersion in a weak solution of chloride of lime.

Iron-buff, or **Nankin Yellow,** is produced by precipitating a ferric salt with an alkali, or alkaline carbonate. It is used principally on cotton.

Prussian Blue is produced on cotton by first mordanting the fibre with ferric oxide, and then immersing it in yellow prussiate of potassium. It is also used in weighting silks which are afterward to be dyed black.

The coal-tar colors which constitute the class of artificial organic dyes are practically innumerable. Several thousand of these dyes have been prepared and hundreds of them have been named. New ones are continually being discovered in new combinations, and many which formerly were highly esteemed have been superseded by better ones.

From the dyer's point of view, these multitudinous dyes have been thus classified:

I. **Direct Cotton Colors, or Salt Colors** — which, in a neutral or weakly alkaline bath containing common salt or Glaubersalt, dye cotton in full shades without mordants.

II. **Sulphide Colors, or Sulphur Colors** — which, dissolved with the aid of sodium sulphide, dye cotton in full shades from a sulphide bath without mordants.

III. **Basic Colors** — those having the qualities of bases, dyeing animal fibres without mordants, and vegetable fibres with tannin mordants.

IV. **Eosins and Rhodamines** — of exceptional brilliancy; the first for silks, the second for silks, wools and tannin-mordanted cotton and cotton-mixed goods.

V. **Acid Colors** — salts of color acids, dyeing animal fibres without mordants.

VI. **Mordant Colors** — which require metallic mordants to fix their colors.

VII. **Acid Chrome Colors** — requiring an acid bath; they dye on wool with chrome mordants.

VIII. **Miscellaneous Colors** — including aniline black; indigo and other vat dyes; and the insoluble azo-colors, known as "ice-colors."

Space does not permit specification of even the coal-tar colors in commonest use. For a condensed review of upwards of 900 of the more prominent of these dyes the student is referred to Arthur C. Green's 'Organic Colouring Matters.' See also COAL-TAR COLORS.

Production.— The United States census of manufactures for 1914 reported 112 establishments of factory grade manufacturing dyestuffs and extracts in the United States in that year. They employed 3,551 persons, of whom 2,839 were wage earners, receiving annually a total of $1,613,000 in wages. The capital invested aggregated $21,283,974, and the year's output was valued at $20,620,336; of this, $7,382,341 was the value added by manufacture to the $13,237,995 worth of materials used. In addition, there were 22 establishments which reported dyestuffs and extracts as subsidiary products. Their value for the year specified was $764,353. Consult Cain, J. C., and Thorpe, J. F., 'The Synthetic Dyestuffs' (London 1913); Fay, I. W., 'Chemistry of the Coal-Tar Dyes' (New York 1911); Knecht, E., Rawson, C., and Loewenthal, R., 'A Manual of Dyeing' (London 1910).

DYEWEED, DYER'S BROOM GREENWEED, or **WOADWAXEN,** a plant, *Genista tinctoria,* of the family *Fabaceæ.* The genus comprises about 80 species, natives of Europe, northern Asia and Africa. The dyeweed is a low-branching shrubby plant, with a few yellow nearly sessile flowers. It was originally cultivated in New England gardens because of the green dye it produced and escaping is found from Maine to eastern New York. Its medicinal value is small, although it is used in popular practice in Russia as a specific for hydrophobia.

DYING DECLARATION, a deposition made by one who is near to death. Such declarations are admitted as evidence both in England and Scotland.

DYING GAUL, a famous work of ancient sculpture, representing a dying Galatian and supposed to be one of a series of figures illustrating the incursion of the Gauls into Greece. The work is now preserved in the museum at Rome. It is not known whether the statue is an original or a copy, the work of Cresilas, a Grecian sculptor and contemporary of Phidias. The right arm of the statue has been restored and it is not positively known by whom this restoration was made. The work has been credited to Michelangelo.

DYKE, or **DIKE,** a word variously used to represent a ditch or trench and also an embankment, rampart or wall. It is specially applied to an embankment raised to oppose the incursions of the sea or of a river, the dykes of Holland being probably the most notable examples of works of this kind in the world. Owing to the possibility of great loss of property and of life, the punishment of all neglect or for malicious mischief to dykes is extremely severe, one "placaat" of Feb. 1726 regulating the inundation in the province of Staten, proclaiming that "anyone cutting dams, dykes, quays, etc., will be punished with death and confiscation of all his property." The dykes which protect the Netherlands and the German coasts of the North Sea go back to the old Roman times. Apparently even before the Romans appeared the Batavians at the mouth of the Rhine protected themselves by dykes. Drusus after the conquest of Holland, 10 B.C., built an elaborate system of artificial canals and dykes. Pliny the Elder gives interesting descriptions of the artificial hills which were erected as places of refuge during the floods.

Among the provinces in North and South Holland which have been protected by dykes may be mentioned the province of Hanover, 618 miles, protecting 770,000 acres of marsh land. On the left bank of the Oder River there is a dyke which protects more than 170,000 acres of land. The dyke at the delta of the Vistula protects 134,000 acres of land. On the lower Rhine, between the Weser and Holland are 115,000 acres protected by dykes. Along the Loire River are 280 miles protecting

230,000 acres. Along the Po there are 310 miles protecting 850,000 acres. In England there are 1,750,000 acres protected by dykes. Many of the dykes of Holland are raised 40 feet above high-water mark and are wide enough at the top for a general roadway or canal, sometimes for both.

In the United States the term dyke is almost wholly restricted to the structures of more or less permanence built in various ways in the bed of a stream to regulate its flow, narrow the low water cross-section, concentrate the current, increase its local scouring effect and thereby deepen the river channel. The earthen embankments designed to restrain the flood waters are called levees. The most notable examples are found along the Mississippi River. These levees are placed some little distance back from the river and according to the local conditions vary in height from 2 or 3 feet to over 20 feet. Levee building began many years ago along the lower part of the river and it has been carried on practically continuously ever since. See MISSISSIPPI LEVEE SYSTEM, and RESERVOIR.

DYKES, James Oswald, Scottish clergyman: b. Port Glasgow, 14 May 1835; d. 1 Jan. 1912. He entered the Presbyterian ministry in 1859, and in 1869 became minister of the Regent Square Church in London. From 1888 to 1907 he was principal in the theological college of the Presbyterian Church of England. He was the author of 'Beatitudes of the Kingdom' (1872); 'Laws of the Kingdom' (1873); 'Relations of the Kingdom' (1874); 'Daily Prayers for the Household' (1881); 'Plain Words on Great Themes' (1892); 'The Christian Minister and His Duties' (1908); 'The Divine Worker in Creation and Providence' (1909), etc.

DYKES, John Bacchus, English composer and theologian: b. Hull, 10 March 1823; d. 22 Jan. 1876. He was graduated at Cambridge, where he won distinction as a musician. He was ordained in 1847 and was appointed minor canon and precentor of Durham Cathedral in 1849. In 1862, being appointed vicar of Saint Oswald's in Durham, he resigned the precentorship, retaining the minor canonry. Becoming involved in 1874 in a dispute with his bishop on questions of church ritual, he was brought to an ecclesiastical trial, after which his health broke completely and his death soon followed. He was buried in the churchyard of Saint Oswald. As a testimonial of affection for him, a fund was raised for the care of his family and within a few weeks reached the notable sum of $50,000. He was a joint-editor of 'Hymns Ancient and Modern,' and composed, besides many services and anthems, a large number of hymn tunes remarkable for harmonic beauty and of striking individuality; most of which are to be found in all English collections. Among these are Bonar, Dominus Regit Me, Gerontius, Hodnet, Hollingside, Horbury, Lux Benigna, Melita, Nicæa, Saint Aëlred, Saint Anatolius, Saint Bees, Saint Cross, Saint Cuthbert, Saint Godric, Saint Sylvester — to mention only a few of those which have become famous. See Lightwood, J. T., 'Hymn-Tunes and Their Story' (London 1908). Besides his musical works he left many literary remains in the line of sermons and contributions to religious periodicals.

DYNAGRAPH, an apparatus used in modern railroading for recording the oscillations of the car, variations in the level of the rails, condition of the rail joints, the alignment of the track and the elevation of the outer rail on curves. These conditions are recorded on a paper ribbon in such a way that any one of them may be accurately located on the ground afterward. The action of the instrument is through gearing to the wheels of the car in which it is mounted. By electric connections a record may also be made of the amount of coal and water consumed by the locomotive hauling the train, the varying pressures of steam in the boiler, the tension on the drawbar and the distance traveled in any particular group of seconds, minutes or hours during which the train is running. The dynagraph is in constant use on all the principal railroads.

DYNAMETER, an instrument in the nature of a micrometer tube attached to the eyepiece of a telescope for measuring its magnifying power. This power is the ratio of the solar focal distance of the object glass to the focal distance of the eye-piece considered as a single lens. This being the same as the ratio of the diameter of the aperture of the telescope to the diameter of its image formed beyond the eyepiece, the object of the instrument is to measure the exact diameter of this image.

DYNAMIC METAMORPHISM. See METAMORPHISM.

DYNAMIC UNITS. See UNITS OF MEASUREMENT.

DYNAMICS OF MACHINERY. When an engine has been proportioned to sufficient capacity and strong enough in all its parts to transmit or develop a given amount of power there still remains the problem of dynamic design which deals with the engine in operation. The requirements in dynamic design are freedom from vibration, constant speed for a given load, and automatic adjustment of the energy developed to the work to be done. Vibrations are produced by the forces which arise from the accelerations of moving masses. An engine or motor in which these forces are counteracted is said to be *balanced*. The speed for a given load is controlled by means of a *flywheel*; a *governor* adjusts the supplied energy to the load.

Rotating Balance.—A particle of weight W revolving with an angular velocity ω radians per second in a circular path of radius r exerts a force called the kinetic reaction, $mr\omega^2$, where $mg = W$, on the constraint which deflects it from a rectilinear path. If the kinetic reactions on a rotating shaft are not in equilibrium, which is usually the case for very high speeds, the shaft will bend and therefore whirl and wear its bearings out of shape. An elementary account of whirling, which lack of space forbids here, is given in Stodola's 'Steam Turbines.' The problem has been investigated experimentally by Dunkerly, 'On the Whirling and Vibrations of Shafts' (Phil. Trans. Vol. CLXXXV) in which earlier references are cited; for a rigorous theoretical discussion consult Chree, 'The Whirling and Transverse Vibrations of Rotating Shafts' (Proceedings of Physical Society, London, Vol. XIX). Torsional vibrations are discussed by Chree and

others in Proceedings Inst. Civil Engineers (Vol. CLXVI), Frahm, *Zeit. d. Verein deut. Ing.* (1902, pp. 779, 886) and Roth (ibid. 1904, p. 564).

When a number of masses all move in one plane perpendicular to the axis of rotation as

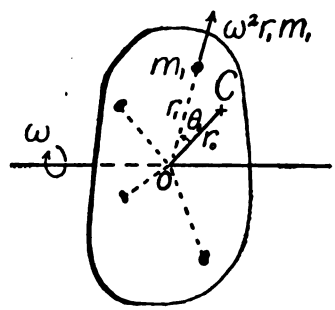

FIG. 1.

in Fig. 1 the criterion for a balanced system of kinetic reactions is found as follows: Assume the centroid C of all the masses to lie at r_o from the axis. Any infinitesimal element of mass m_1, situated at (r_1, θ_1) exerts a force $\omega^2 r_1 m_1$ along r_1. The reaction normal to OC in the plane of rotation is

$$\omega^2 (m_1 r_1 \sin \theta^1 + m_2 r_2 \sin \theta^2 + \ldots).$$

Since the centroid lies on OC the parenthesis is zero, hence there is no force normal to OC. The force along OC is

$$\omega^2 \Sigma mr \cos \theta = \omega^2 r_o \Sigma m,$$

whence the resultant kinetic reaction of a system of masses rotating in one plane normal to the axis is the same as if the total mass were concentrated at the centroid. Therefore if the resultant is to vanish, i.e., if the system is to be in *running balance*, the centroid must lie on the axis of rotation; from a viewpoint more convenient for the solution of problems, the system is balanced when the kinetic reactions are in equilibrium. ω may be taken as unity. But when the centroid is on the axis the system will remain in any position into which it is turned. This is called *standing balance*. Thus rotating parts such as armatures, turbine runners and flywheels that are constructed to be in standing balance will also be in running balance at any speed provided the centroids of all the parts are coplanar. This condition is usually not fulfilled; furthermore although perfect balance is independent of ω, unbalanced forces increase as ω^2 so that deviations from equilibrium so small as to be unnoticed when the system is at rest may yet have an appreciable effect at great speeds. For example, if a system of 1 lb. weight is mounted eccentrically 0.0001 inch, the turning moment due to gravity is only 0.00009 ft.-lb., while at a speed of 1,500 r.p.m. the unbalanced radial force is almost 0.7 lb., at 2,500 r.p.m. about 1.9 lb.

Fig. 2 shows the general case of rotating balance where the masses are not coplanar; i is the projection on a plane through the shaft and one arm r, and ii is an end view of i. If the kinetic reactions on the shaft are denoted by C, C_1, C_2, ... along r, r_1, r_2, ... in ii, the conditions for equilibrium are found by resolving along and perpendicular to r in ii and by taking moments about a perpendicular to both r and the shaft, and also about r itself. There results

$$C - C_1 \cos \theta^1 - C_2 \cos \theta^2 \ldots = 0 \quad (1)$$
$$C_1 \sin \theta^1 + C_2 \sin \theta^2 \ldots = 0 \quad (2)$$
$$Cl_1 \cos \theta^1 + C_2 l_2 \cos \theta^2 \ldots = 0 \quad (3)$$
$$Cl_1 \sin \theta^1 + C_2 l_2 \sin \theta^2 \ldots = 0 \quad (4)$$

Four unknowns can be determined from these four equations; but not more than two of them can be lengths l because only two equations contain l. The most convenient unknowns for practical work are two pairs of reaction components, one pair at each of two arbitrarily selected points. The reactions themselves may then be found and the proper masses and radii selected accordingly. In short, any system of revolving masses can be balanced by two masses properly placed; the positions of their radii along the shaft are arbitrary but their directions are not. The foregoing solution may be carried out graphically. Suppose that in Fig. 2 the magnitudes and positions of M_1, M_2, M_4 are known and it is required to find $C = mr\omega^2$ and $C_3 = m_3 r_3 \omega^2$ in magnitude and direction. Equations (3) and (4) show that if the moment of each force

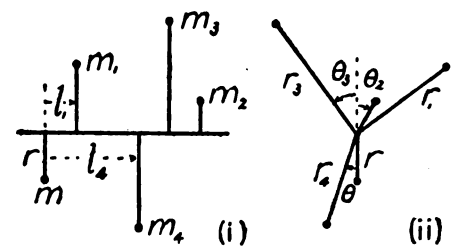

FIG. 2.

about an axis perpendicular, at any point, to the plane through the shaft and the force be regarded as a vector having the direction of the force, the vector sum of all the moments will be zero. Two like forces on opposite sides of the axis have opposite moments which must have opposite senses. By taking the origin first at one unknown force and then at the other and drawing the vector polygon of the moments, the moments of the required kinetic reactions can be found. These determine the forces themselves since the lever arms l are known. The work may be checked by constructing the force polygon corresponding to Fig. 2, ii. The method of procedure will now be illustrated.

Example. Two cranks at right angles are of 10 inch radii, the distance between them being 1.5 ft. The mass at each crank weighs 320 lbs. Find the balance masses at 1 ft. outside of each crank.

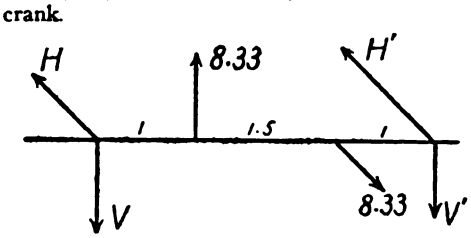

FIG. 3.

Take $\omega = 1$, then $mr\omega^2 = 8.33$. Fig. 3 shows a perspective view of shaft as a free body; H, V and H^1, V^1 are the horizontal and

vertical components of the required forces. H and H^1 will evidently point away from the reader. For equilibrium

$$V + V^1 = 8.33, \quad H + H^1 = 8.33$$
$$3.5\,H^1 = 8.33 \times 2.5, \quad 3.5\,V^1 = 8.33 \times 1$$
$$\therefore\ H^1 = 5.96,\ H = 2.37,\ V^1 = 2.38,\ V = 5.95.$$

The results were obtained on a slide rule; evidently $V = H^1$, $V^1 = H$.

The resultant C of H and V is inclined at

$$arctan\ 5.95/2.37 = 68°\ 10'\ below\ H.$$

To solve the problem graphically select an origin at the point of application of each unknown force and take the moment of each force about an axis normal to the plane through that force and the shaft. The moment polygons are shown in Fig. 4.

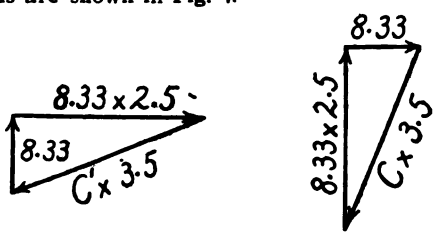

FIG. 4.

Now find C and C^1 and from them calculate what masses at the given radii will balance the two cranks.

Unfortunately the subject of revolving balance is not disposed of so easily. A locomotive wheel-pair or a crank shaft may be symmetrical in form and may even be in standing balance without however being in running balance. A disc carefully turned on a lathe is not necessarily in balance because the metal might not be homogeneous. Even if its centroid is on the axis it is quite possible that the material on one side of a plane through the body and perpendicular to the axis may not be dynamically symmetrical with the material on the other side, or the plane of the wheel might not be exactly perpendicular to the axis. The above mathematical methods are indispensable in arranging the positions of cranks and balance weights but the final adjustments must be made experimentally. For this purpose the part to be balanced is mounted and run on a movable platform which can respond to the unbalanced reactions produced by rotation. The platform is sometimes supported by a spring at each corner and vibrates unless running balance exists. In the Norton Balance Indicating Machine, made by the Norton Grinding Company of Worcester, Mass., the axle holding the piece to be examined is mounted on two pendulums which oscillate in response to the motion of unbalanced masses. For details of the method consult a pamphlet on Dynamic Balance issued by the Norton Company. For the Akimoff machine consult Akimoff, 'Recent Developments in Balancing Apparatus' (in *Journal of the American Society of Mechanical Engineering*, December 1917), also 'Transactions American Society of Mechanical Engineering' (Vol. XXXVIII, p. 367). The Lavaczeck machine is described in *Jour. A. S. M. E.* (March 1916) and in *Zeitschrift Ver. deut. Ing.* (Vol. LX, Nos. 1, 2, 1916).

Reciprocating Balance.— Fig. 5 represents the connecting rod mechanism, P being the crankpin and C the crosshead.

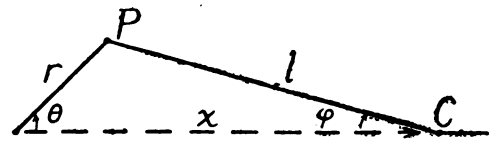

FIG. 5.

If the angular velocity $\omega = \dot{\theta}$ of the crank is assumed constant the acceleration of C is the second time-derivative of x and is negative because x decreases as θ increases. Now

$$x = r\cos\theta + l\cos\varphi$$

but since $\sin\varphi = r/l\,\sin\theta = 1/n\,\sin\theta$

$$\cos\varphi = \left(1 - \frac{\sin^2\theta}{n^2}\right)^{\frac{1}{2}} = 1 - \frac{\sin^2\theta}{2n^2},\ \text{approx.}$$

$$\therefore \quad x = r\cos\theta + l - r\,\frac{\sin^2\theta}{2n} \quad \text{approx.}$$

$$v = -\dot{x} = r\omega\left(\sin\theta + \frac{\sin 2\theta}{2n}\right) \quad \text{approx.}$$

$$a = -\ddot{x} = r\omega^2\left(\cos\theta + \frac{\cos 2\theta}{n}\right) \quad \text{approx.}$$

If the mass of all reciprocating parts is m then ma is the kinetic reaction in the line of stroke transmitted by the connecting rod to the crankpin. But the connecting rod also has mass; if we neglect rotation and consider only translation its mass may be divided into two parts, one reciprocating with C and one rotating at P. Their centroid must coincide with that of the rod. If m thus includes the piston and crosshead system and the proper part of the rod, a variable force

$$mr\omega^2\cos\theta + \frac{mr^2}{4l}(2\omega)^2\cos 2\theta,\ \text{approx.}$$

acts at P in the line and direction of the stroke. This force is transmitted to the shaft and produces to and fro vibrations. There are other terms containing $\cos 4\theta$, $\cos 6\theta$, etc. but they do not contribute more than about ½ per cent to the expression. The first or primary term equals the component, in the line of stroke, of a mass m rotating at the crankpin with velocity ω; it may be equilibrated by attaching an equal mass diametrically opposite P at radius r. But the vertical component $mr\omega^2\sin\theta$ of the kinetic reaction exerted by the attached mass will be unbalanced. It produces the so-called *hammer-blow* on the rails of a locomotive. Perfect primary balance of a single cylinder engine is therefore impossible; any attempt results in compromise. It is customary to balance only two-thirds of the reciprocating masses. That is, all the parts actually rotating, two-thirds of the parts actually reciprocating, and the proper part of the connecting rod are regarded as concentrated at the pin and then balanced for rotation.

The *secondary* term equals the stroke component of a mass m rotating at radius $r^2/4l$ with velocity 2ω; this secondary crank makes twice the angle with the line of stroke that the actual crank does. It is impossible to balance the secondary force in a single cylinder unless some auxiliary mechanism is introduced to rotate the secondary imaginary crank. The secondary

effects are always large enough to produce decided vibrations such as occur in the usual type of four-cylinder automobile engine in which the primary disturbances are counteracted.

Since the above process reduces reciprocating to rotating balance the necessary conditions to be fulfilled for a multicylinder engine are

$$\textit{Primary}\quad \Sigma mr = 0,\ \Sigma mrx = 0$$

$$\textit{Secondary}\quad \Sigma m\frac{r^2}{4l} = 0,\ \Sigma m\frac{r^2}{4l}x = 0$$

where x is the distance of any crank from any assumed origin. This is Schlick's method of balancing a multicylinder engine. Consult Schlick in *Zeit. d. Verein Deut. Ing.* (1894). For a general discussion consult Schubert, *Mitt. math. Gesell.* (Hamburg Bd 2, Heft 8, 1898); Schlick in Trans. Inst. Naval Arch. (Vol. XLII, 1900). The subject is thoroughly treated in Lorenz, 'Dynamik der Kurbelgetriebe' (1901); Dalby, 'Balancing of Engines' (2d ed.); Sharp, 'Balancing of Engines' (1907). In a two-crank engine with equal reciprocating weights and cranks at 180 degrees the primary forces are balanced but there is an unbalanced primary moment about a vertical axis; secondary effects cannot be balanced. For three cranks at 120 degrees the forces of both orders vanish but not the moments. Primary and secondary balance will obtain in a four-crank engine when two of the cranks are coplanar; this arrangement is not practicable; in the usual arrangement all except the secondary moments vanish. Five- and six-cylinder engines will be in complete balance when the cranks are 120 degrees apart, no two being coplanar; in the former the first and fourth cranks must be parallel and also the second and fifth; in the latter the first and sixth, second and fifth and third and fourth. The rotational motion of the connecting rod is

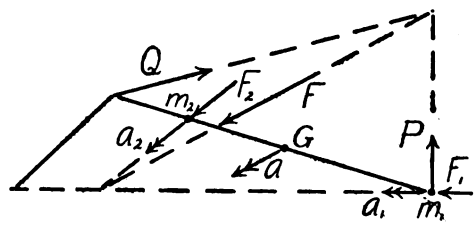

FIG. 6.

only partially allowed for above. To find its exact effect imagine the rod replaced by two particles m_1 and m_2, m_1 being at the crosshead and m_2 at some distance d_2 beyond the centroid G as in Fig. 6. If the new system is to have the same mass m, the same centroid, and the same moment of inertia mk^2 as the rod, d_1 being the distance from m_1 to G, and d_2 from G to m_2

$m_1+m_2=m$, $m_1d_1=m_2d_2$, $m_1d_1^2+m_2d_2^2=mk^2$

$\therefore d_1d_2=k^2$ so that d_1+d_2 is the length of the equivalent simple pendulum which can be found experimentally. The position of G is got by weighing the ends of the rod. Let a_1 and a_2 be the accelerations of m_1 and m_2; then the forces F_1 and F_2 producing a_1 and a_2 will have a resultant F causing the actual motion of the rod. Hence F must be parallel to a and concurrent with F_1 and F_2. In kinematics (q.v.) it is shown how to find the accelerations graphically. To find the effect of the kinetic reaction exerted *by* the rod resolve F, *reversed*, into components P and Q, P being perpendicular to the crosshead guides and Q passing through the crankpin. P tends to lift and rock the engine and Q exerts a perturbating moment around the shaft.

The Flywheel.—The driving moment exerted by a piston engine varies throughout the stroke on account of the obliquity of the connecting rod, the varying steam or gas pressure and the kinetic reactions of the accelerating masses. If P is the resultant steam force on the piston at

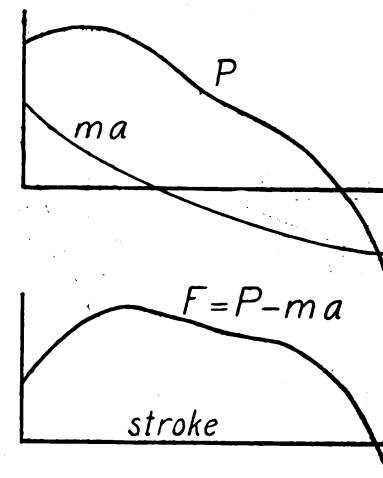

FIG. 7.

any instant and m the mass of the reciprocating parts, the effective piston force at the crosshead is $F=P-ma$. P is obtained from indicator diagrams and is the difference between the forward and the back gas forces; the acceleration diagram of the crosshead (see KINEMATICS) gives ma. These, together with F, are shown in Fig. 7 for half a revolution or one stroke. To find the driving moment produced by F consider Fig. 8. The thrust along the rod is $T=F\ sec\ \phi$ and its lever arm is $d=h\ cos\ \phi$

$$\therefore\quad Td=Fh$$

where h is to be found graphically from the intersection of the connecting rod with a vertical through the shaft as in Fig. 8. To allow for the inertia of the rod the moment of Q about the shaft, see Fig. 6, must be subtracted from Fh; the resultant D is the effective driving moment and is shown roughly in Fig. 9, where, however, Q is neglected. It is usually

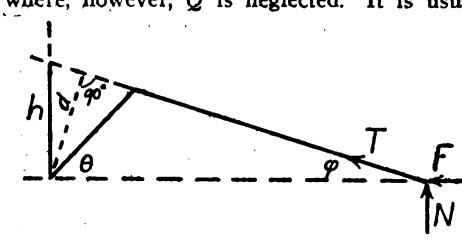

FIG. 8.

considered accurate enough to neglect the rotational effect of the rod and to assume, as in balancing, that part of it reciprocates with the crosshead. The work done by the driving mo-

ment in a single revolution equals the work done by the resistance, for otherwise the engine would speed up or slow down progressively. If the resisting moment, say R, is constant, as it nearly is in dynamos, blowers, spinning machines, etc., it may be represented by the ordinates of the rectangle in Fig. 9 whose area equals that under the curve. Even if the resistance is variable, R is the average moment

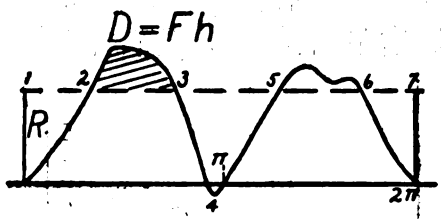

FIG. 9.

per cycle; no work is gained or lost on account of changes in kinetic energy because the motion repeats itself after each revolution. The kinetic energy changes only the distribution of the work put in. R is obtained from the brake horse power. Friction losses have not been considered but they are comparatively small in a well-designed engine and are best found experimentally.

The area of the D curve above the rectangle equals the area below and is the change in kinetic energy. From (1) to (2) $R>D$ and the engine slows down; from (2) to (3) $R<D$ and the motion is accelerated. The energy acquired from (2) to (3) is used up from (3) to (5) and then acceleration begins again. The velocity is greatest at (3) and (6) and least at (2) and (5); suppose it to be larger at (3) than (6) and less at (2) than (5). Now if E is the kinetic energy of the moving parts at any instant, $\Delta E = E_3 - E_2$ is the energy stored in them and equals the work done by $D-R$ from (2) to (3), i.e. the shaded area. ΔE is called the *fluctuation of energy*. If the moment of inertia of all rotating parts is I, and if for a first approximation the reciprocating masses are neglected

$$\Delta E = \frac{I}{2}(\omega_3^2 - \omega_2^2) = I(\omega_3 - \omega_2)\frac{(\omega_3 + \omega_2)}{2}$$

where ω is the crank velocity. Usually the change in speed is not large so that approximately $\omega_3 + \omega_2 = 2\omega$, where ω is the mean speed. If the mean energy is $E = I\omega^2/2$

$$\frac{\omega_3 - \omega_2}{\omega} = \frac{\Delta E}{2E}$$

which is the *coefficient of fluctuation of speed* and is half the *coefficient of fluctuation of energy*. In piston pumps and shearing and stamping machines it may be as high as 0.05; in dynamos for lighting purposes it may be 0.01 and even less. By means of this formula a flywheel can be designed to keep the extreme speeds within specified limits; ΔE is to be got from Fig. 9. In multicylinder engines the moment curves for the separate cylinders are superposed; the resultant has smaller fluctuations from the mean than the components.

Governors.— The function of a governor is so to regulate the supply of power according to the varying work an engine has to do that the mean per revolution speed changes as little as possible. The flywheel on the contrary equalizes the driving moment during one revolution. If the load is constant no governor is required although of course a flywheel is necessary. The governor controls the energy supplied to a steam engine, for example, by changing the point of cut-off to alter the quantity of steam or by operating the throttle valve to alter the pressure. It should act only when the change in speed is greater than the cyclic fluctuation. A governor which operates during the small cyclic variation which it is the function of the flywheel to smooth out is too sensitive; it will oscillate or *hunt* and by actuating the valve or cut-off mechanism it will change the power so as to reinforce the oscillations and thus produce irregularities in speed which it was designed to correct. The speed of an engine cannot be kept absolutely constant because a governor acts only through a change in speed; moreover since the action is not instantaneous the supply of power always lags behind. The most that can be expected is to keep the variation of speed within sufficiently narrow limits.

Centrifugal governors, which are commonly used, operate by means of the kinetic reactions of revolving masses. The first governor was invented by Watt and was merely a double conical pendulum; as the balls rose or fell they actuated a suitable mechanism for controlling the supply of power. The general principles will be explained in connection with the *loaded* governor, a modification of the Watt form due to Porter. The vertical spindle is geared to

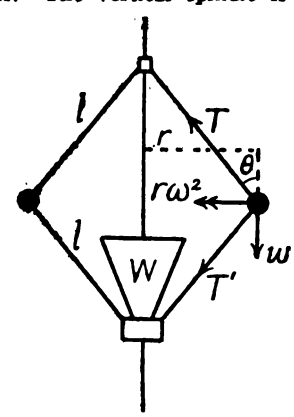

FIG. 10.

the shaft, the sleeve at the bottom being linked to the power controlling mechanism. This may be taken as the type of all centrifugal governors in some, e.g., the Proell and the Hartnell, the load is replaced by a spring; in others such as the Hartung the revolving weights are directly connected by a spring without the aid of oblique arms. When the governor is in equilibrium at speed ω, each ball is acted on by the forces shown; for brevity we shall suppose the arms to be of negligibly small mass. Then

$$T\cos\theta = T'\cos\theta + w$$

$$(T + T')\sin\theta = \frac{w}{g}r\omega^2$$

$$2T' = \frac{w}{g}\frac{r\omega^2}{\sin\theta} - \frac{w}{\cos\theta}$$

If the sleeve weight is W then $2T' \cos \phi = W$ whence $\frac{w}{g} r\omega^2 = (w + W) \tan \theta$. When the speed increases or decreases the sleeve tends to move up or down and a friction force F acts at the sleeve to oppose the motion. Friction F will consequently permit a certain change in speed $\Delta\omega$ without a change in configuration. Hence $\frac{w}{g} r (\omega \pm \Delta\omega)^2 = (w + W \pm F) \tan \theta$ which by the previous equation becomes

$$\frac{w}{g} r (2\omega \Delta\omega + \Delta\omega^2) = F \tan \theta$$

where $\Delta\omega$ is the change on each side of mean speed which the governor will allow without acting. If $2\Delta\omega$ is less than the fluctuation within a cycle the governor is too sensitive to be useful. Suppose now that the speed changes by more than $\Delta\omega$, increases, say, from ω to ω'; the balls will fly outward and the sleeve will rise. Unless the sleeve load is sufficiently increased, as in the spring-loaded form, the sleeve will overshoot the position corresponding to ω' and oscillations will be set up. We are dealing only with the statical theory; for a discussion of the kinetic theory consult Lecornu, 'Dynamique appliquée' (1908); Kroener, 'Die Geschwindigkeitsregler der Kraftmaschinen' (1912), and for an exhaustive treatment, Tolle, 'Die Regelung der Kraftmaschinen' (1910). But the rise of the sleeve is accompanied by the work of operating the valve; this produces an average force P on the sleeve, P being called the *effort*. The work done by P is usually called the *power* of the governor, but *powerfulness* is a better name, because "power" is used in a different sense in mechanics. Sensitiveness is measured by the rise or fall of the sleeve for a given percentage change in speed. A governor is *stable* when each configuration corresponds to a definite speed and vice-versa. When equilibrium exists for only one speed the governor is isochronous and is then infinitely sensitive. Isochronism will obtain when the balls are so linked that they rise and fall in parabolic paths; it is not desirable, since it causes hunting.

The functioning of a governor is exhibited most clearly by means of diagrams. The kinetic reaction exerted by the balls of any centrifugal governor is called the *controlling force* and is denoted by C where $C = mr\omega^2$, m being the mass of the two balls. Now plot C as ordinate and r as abscissa; the curve, Fig. 11, so obtained is the *characteristic* and was suggested by Hartnell (*Proc. Inst. Mech. Eng.* 1882) and developed by Tolle (*Zeit. d. Verein deut. Ing.* 1895). For the Porter governor C is twice the value of $w\ r\omega^2/g$ given below Fig. 10. Friction is omitted. The power or powerfulness is by definition, see above, the area under the C curve. The properties of the characteristic are usually stated without sufficient proof; the necessary details are as follows. From $C = mr\omega^2$

$$\frac{dC}{dr} = \frac{C}{r} + 2mr\omega \frac{d\omega}{dr}$$

If ω is constant for all values of r the governor is isochronous. In this case $\frac{dC}{dr} = \frac{C}{r}$ and the locus is a straight line through the origin. If r increases with increase of ω the sleeve is lifted and reduces the power input. Then since $d\omega/dr$ is positive, $dC/dr > C/r$ whence the condition for stability is that the slope of the characteristic curve at any point must be larger than the slope of the line through that point and the origin. If r decreases for an increase in ω then $d\omega/dr$ is negative and $dC/dr < C/r$, which implies instability. The coefficient of fluctuation of speed can be found from Fig. 11. Let C correspond to the normal

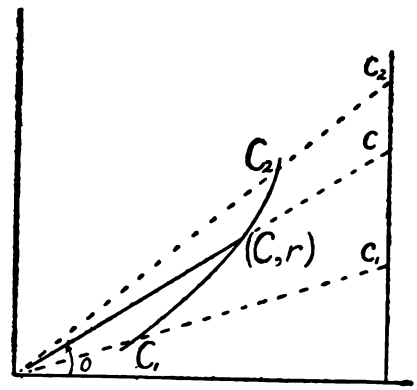

FIG. 11.

configuration at mean speed, and C_1 and C_2 to the extreme speeds. Draw a vertical at any point and radii through C_1, C, C_2 to cut it at c_1, c, c_2. If b is the abscissa to the vertical, $c = bm\omega^2$ and as $\omega = (\omega_2 + \omega_1)/2$ approximately, the coefficient of fluctuation is

$$\frac{c_2 - c_1}{c} = \frac{\omega_2^2 - \omega_1^2}{\omega^2} = \frac{\omega_2 - \omega_1}{\omega}$$

We have excluded friction; its effect is to shift the characteristic up or down as the balls fly out or in. The controlling force at the balls produces an effort P at the sleeve where there is also a static force S due to the load or spring and the power regulating mechanism. L. Rith (Les Regulateurs à force centrifugal, Memoirs de la Soc. des Ing. Civ., September 1905, No. 9) plots the (P, ω^2) and (S, ω^2) curves for several positions of the balls. These loci are all straight lines and are useful in studying the behavior of a governor. Consult Dalby, 'Steam Power' (§ 110, 1915) for the details.

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DYNAMITE (from Greek *dynamis*, power), an explosive invented by Nobel in 1866 and originally consisting of infusorial silica or diatomaceous silica, called "kieselguhr," and nitroglycerin. The kieselguhr, being composed of the siliceous skeletons of micro-organisms, is a very fine, dry powder with a great capacity for absorbing and holding liquids, and it will absorb and retain three times its own weight of nitroglycerin, so that the product contains 75 per cent by weight of the nitroglycerin, and is known as dynamite No. 1. Other grades are made by adding less nitroglycerin to the absorbent or dope. The name has now been extended to cover a great variety of pulverulent or plas-

tic solid mixtures of which nitroglycerin is a component.

Dynamite is fired by means of a detonator or blasting cap. As the percentage of nitroglycerin in dynamites with inert bases is reduced, they become more difficult to detonate until when the nitroglycerin is below 30 per cent they cannot, according to Howe, be detonated at all. This does not hold true for dynamites with active bases. Dynamite is usually put up in cylindrical brown paper wrappers, closed at each end and coated with paraffin. These cartridges or "sticks," as they are called, are usually from one to two inches in diameter and eight inches long, and they are packed for transportation in sawdust in wooden cases, there being 50 pounds in each case. The sticks are paraffined to prevent water reaching the dynamite, as this drives the nitroglycerin out of the kieselguhr dynamites and dissolves the nitrate of soda in the nitro-lignin dynamites, thereby diminishing their efficiency. Good dynamite is of about the consistency of fresh mold. It varies greatly in color according to the absorbent used, magnesia powder being snow white, kieselguhr dynamite No. 1 pearl gray to red, carbo-dynamite black, the lignin dynamites about the color of coarse brown sugar. There is usually a little sodium, calcium, or magnesium carbonate, mixed with the dope. Dynamite keeps as well as the nitroglycerin, from which it is made. It is safer than the latter, because it avoids the liquid state, while from its softness it will bear blows better. Its sensitiveness to blows increases very rapidly with the temperature, so that, according to Eissler, "at 350° F., the fall upon it of a dime will explode it." At ordinary temperatures it may be exploded by firing musket balls into the mass. The firing point of dynamite is about 180° C. (356° F.), and at this temperature it either burns or explodes. If free from all pressure, jar, vibration, or force of any kind, it burns; otherwise, it explodes. If a thin layer be placed on a plate of tin and heated over a burner the nitroglycerin volatilizes or takes fire. If the layer is of any considerable depth, say over a quarter of an inch, it explodes. This is a dangerous experiment. When heated to any temperature less than this, it is exploded by a detonator, blow, jar, or vibration with an ease dependent on the temperature and time of exposure. When ignited in comparatively small quantities dynamite simply burns away fiercely, but with moderate and larger amounts ignition causes explosion. To safely destroy dynamite it should be treated with a solution or emulsion of an alkaline sulphide such as the spent lime from gasworks. High temperatures, much below the ignition or explosion temperature, cause the nitroglycerin to exude, or in technical terms, "they will make the powder leak," hence a dynamite should be made to resist exudation at the highest temperature to which it may be exposed.

Dynamite freezes at about 40° F., and remains frozen at temperatures considerably exceeding this. If solidly frozen it cannot be detonated except with great difficulty and uncertainty, but if loose and pulverulent it may be detonated, though the efficiency is much diminished, hence when frozen it is practically useless as a blasting agent, and must be thawed or "tempered" for use. This operation requires great care and the instructions issued with each case should be closely followed. Many persons suppose that since cartridges of unfrozen dynamite may sometimes be set on fire and burned without exploding, it is safe to warm it upon a shovel, or in an oven, or to boil it over a stove, or in various other ways which usually lead to a verdict of "accidental death." It cannot be too strongly impressed upon the minds of those handling it that if dynamite or other nitroglycerin preparations are gradually warmed up to a temperature approaching their explosion temperatures they become extremely sensitive to the least shock or blow, and once that point is reached they do not simply ignite, but they explode with great violence, and further that, owing to the poor conductivity of the mass, a portion of it may become raised to this temperature and explode the whole.

Dynamite has a specific gravity of 1.5 to 1.6. In his earlier experiments with absorbents Nobel in 1863 placed gunpowder in a zinc case and filled the interstitial spaces with nitroglycerin. This might be called a dynamite with an active base, but that the nitroglycerin was greatly in excess of that existing in dynamites. See EXPLOSIVES; NITROGLYCERIN; POWDER.

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DYNAMO ELECTRIC MACHINERY. See ELECTRIC MACHINES; GENERATORS, ELECTRIC.

DYNAMOMETERS AND THE MEASUREMENT OF POWER. In designing a modern industrial plant or manufactory and in estimating the amount and cost of power for its operation, an accurate knowledge of the amount of power absorbed by the different machines is not only desirable, but essential to economy and efficiency.

If the power required is not known the engine or motor provided may prove incapable of doing the work; or, on the other hand, the motive power may be largely in excess of that required: in either case there is an unnecessary expense — in the first case, in remedying the deficiency; and, in the second, in the daily expenditure for excess of power to overcome friction and other losses. If a more accurate knowledge of the power required to drive machine-tools were known, there would be a greater economy in running them. Moreover, the increasing use of electric motors and internal combustion engines for various purposes has created a demand for accurate determinations of the power developed so that exact methods must be employed in measuring the power.

The attempt to determine the amount of horse power given up by a motor, or required to operate a machine, by considering the velocity and width of belt used in a similar machine is futile and very misleading results are obtained; for while this method will give a close approximation to the amount of power a belt of a given width *ought* to transmit at a given velocity, there is nothing definitely known about the actual stress in the belt, therefore there cannot be anything definitely known about the power transmitted by it.

The only satisfactory method of ascertaining the amount of power is by the use of some form of dynamometer — by which is meant an instrument or machine for measuring the power

exerted by a prime mover, or the amount of power consumed by a machine or group of machines. Among the many machines and devices for measuring power one of the simplest

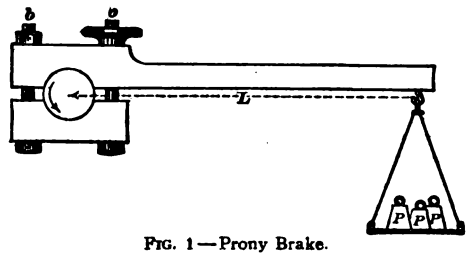

FIG. 1—Prony Brake.

is the Prony friction brake. Primarily this consists of a lever *L*, Fig. 1, connected to a revolving shaft or pulley in such a manner that the friction induced between the surfaces in contact will tend to rotate the arm in the direction in which the shaft revolves. This rotation is balanced by weights *P*, hung in the scale-pan at the end of the lever. A counterpoise attached to the brake-arm is often used in order to balance it before adding weights in the scale-pan. If not balanced, the weight of the lever-arm must be ascertained and its moment added to the total moment of the weight to obtain an accurate measure of the friction. In order to measure the power for a given number of revolutions of pulley, weights are added to the scale-pan and the bolts *bb* tightened, until the friction induced balances the weights and the lever is maintained in its horizontal position, while the revolutions of shaft per minute remain constant. That this measure of the friction is equivalent to a measure of the work of the shaft will be seen when one considers that the entire driving power of the shaft is expended in producing this friction at the required number of revolutions per minute — and this driving power is equal to the mechanical effect of the shaft when running at the same speed in the performance of useful work.

A regulator or dash-pot attached to the end of the lever-arm or scale-beam may be used with the Prony brake — and other various forms of dynamometer in which the pressure is weighed, in order to maintain a more even balance and to prevent vibrations and sudden shocks due to momentary slip of the belt or inefficient lubrication of the brake.

Instead of hanging weights in a scale-pan, as in Fig. 1, the friction may be weighed on a platform-scale; in this case the direction of rotation being the same, the lever-arm will be on the opposite side of the shaft as shown in Fig. 2.

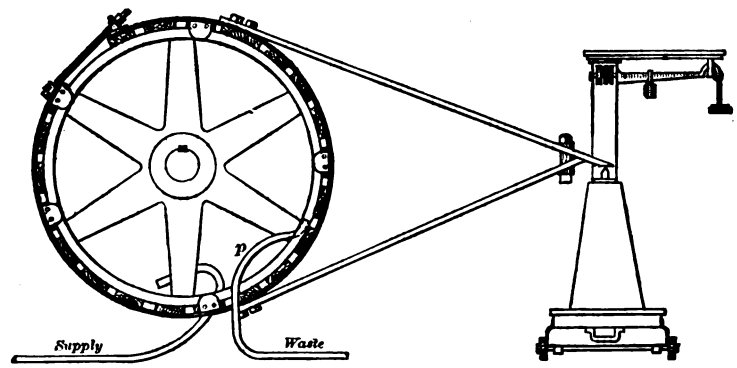

FIG. 2—Water-cooled Brake.

This brake consists of a flexible metal strap to which are fitted blocks of wood forming the rubbing surface; the ends of the strap are connected by an adjustable bolt clamp, by means of which any desired tension may be obtained. A small stream of water constantly discharges into the pulley rim which is provided with internal flanges; a waste pipe *p*, with its end flattened, is so placed in the trough that it acts as a scoop, and removes all surplus water.

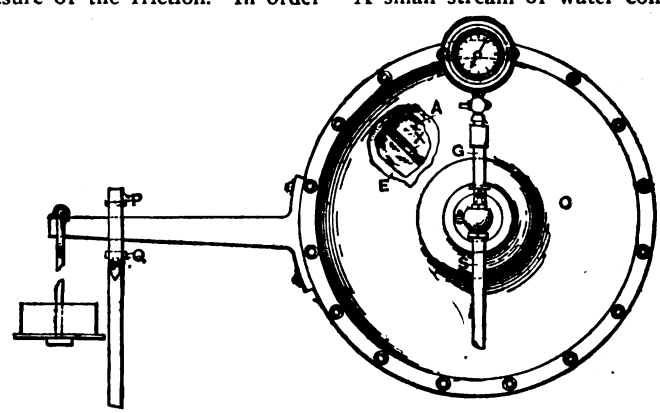

FIG. 3—Alden Brake.

The horse power or work of the shaft is determined from the following: Let W = work of shaft in foot-pounds per minute, equals work absorbed per minute; P = unbalanced pressure or weight in pounds, acting on lever-arm at distance L; L = length of lever-arm in feet from centre of shaft; V = velocity of point in feet per minute at distance L, if arm were allowed to rotate; N = number of revolutions per minute; H. P. = horse power. Then will $W = PV = 2\ L\ N\ P$; therefore since

$$\text{H. P.} = \frac{PV}{33{,}000} \quad \text{H. P. will equal} \quad \frac{2\pi\ L\ N\ P.}{33{,}000}$$

$$\text{If } L = 33 \text{ then H. P. will equal } \frac{NP}{1{,}000}$$

It will be evident that leather belts and ropes may be used as friction brakes to absorb the power of a shaft or motor. In such cases it becomes necessary to ascertain the back tension in the belt or rope and subtract this from the total weight or pull on the other side.

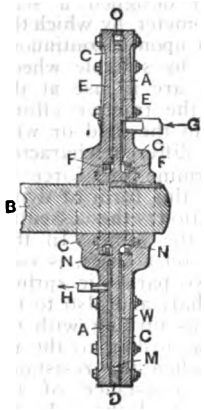

FIG. 4—Section of Alden Brake.

A disc absorption-dynamometer, by which any desired constant load can be maintained on the engine, or motor, is the invention of Mr. George Alden, of Worcester, Mass. This dynamometer is essentially a friction brake in which the pressure causing the friction is distributed over a comparatively large area, thus giving a low intensity of pressure between the rubbing surfaces.

This friction is produced by the pressure of water acting upon two copper plates in contact with a smooth cast-iron disc, keyed to the shaft which revolves in a bath of oil between the plates. These latter are secured by a water-tight joint to a casing which does not revolve, and to which is bolted a lever-arm carrying weights as in an ordinary Prony brake. The shell or casing is so constructed that it permits an equal pressure upon both sides of the disc—a sufficient quantity of the water being allowed to pass through the machine to carry off the heat due to the energy absorbed.

An interesting application of the Alden brake has been made in the Experimental Laboratory of Purdue University by which the power of a locomotive is absorbed. In this arrangement, Fig. 5, the locomotive is mounted with its drivers upon heavy supporting wheels free to revolve in either direction by contact with the drivers: the prolonged axles of the supporting wheels are each provided with a large flat cast-iron disc keyed to the shaft and allowed to rotate in a closed case between plates of copper, which can be forced against the rotating disc by hydraulic pressure as in the Alden dynamometer. The locomotive is free to move forward or backward only through a very small distance (about a quarter of an inch), its tendency to motion in either direction being measured by a system of levers and weights connected to the draw-bar by which the traction of the engine can readily be weighed. Any desired load and speed can be maintained by means of the friction brakes which are bolted securely to stone foundations—in this respect differing from the Alden dynamometer, which is free to rotate through a small arc. A modification of this mounting has been constructed for use in the railway laboratory of the University of Illinois. In this case there are eight supporting wheels arranged on four shafts each provided with a brake at both ends of the shaft. These brakes contain three cast-iron discs which run between copper plates arranged as in the Alden brake. Each of the eight brakes is capable of absorbing 450 horsepower.

Another form of absorption dynamometer is that of Froude originally designed to measure the power of large marine engines. The resistance in this dynamometer is obtained by the reaction of a series of fluid jets maintained at a high velocity by a modified form of turbine which revolves in a casing filled with water, both turbine and casing being mounted on the end of the screw shaft in place of the propeller—the turbine revolving while the casing is dynamometrically held stationary. In a dynamometer of this type the reactions which tend to stop rotation of the turbine and give motion to the casing vary as the square of the speed of rotation of the shaft to which they are attached; and, further, by comparing two similar but differently-dimensioned turbines, the respective moments or reaction for the same speed of rotation will be found to vary as the fifth power of their respective diameters.

An earlier form of hydraulic brake was an ordinary centrifugal pump, the resistance to rotation being regulated by a valve placed in the outlet pipe. This apparatus was rather cumbersome, particularly at low speeds, and the range and method of regulation were not very satisfactory.

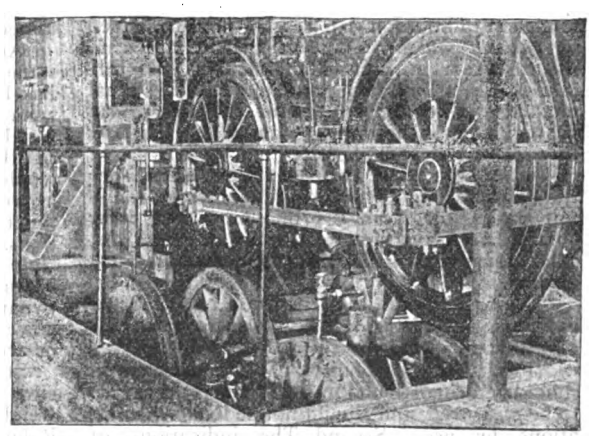
FIG. 5—Locomotive Testing.

The present type of Froude dynamometer which is almost universally used in England for factory purposes, consists of a rotor revolving in water contained in a casing, suitably mounted on friction rollers, and connected to a water

supply. The rotor is fixed on the shaft, which projects on either side of the casing, so that the engine or motor to be tested may be readily coupled to it. Motors running in either direction can thus be tested by coupling to either end of the brake shaft. Each face of the rotor is formed with a semi-elliptical annular channel divided into a number of compartments by means of oblique vanes. The corresponding faces of the casing are also formed with similar channels divided in the same way. When in action the water in each annular channel is rotated continuously by the centrifugal force imparted to it by the rotor, and passes consecutively from one compartment into the next. An extremely high speed of rotation of the water may thus be obtained and the power put into the dynamometer is by this means converted into heat which passes away in the water leaving the machine. Incidentally it is interesting to note that Osborne Reynolds used one of these dynamometers to check the mechanical equivalent of heat and found it to equal 778 foot-pounds — the value now in use. The motion of the water causes the rotor to react on the casing, which tends to turn on the friction rollers. This is prevented by means of an extension arm, working between stops, at the end of which are the balance weights.

The Alden friction brake and the Froude hydraulic brake suggest another form of dynamometer especially useful for absorbing the power developed by high speed machinery such as steam turbines. This machine, which was designed by Prof. J. B. Webb, consists of a series of steel discs, such as old circular saws, connected to a rotating shaft having separating washers between the discs. The shaft and discs rotate within a fixed casing to which a series of annular discs is secured in the rim; these are so spaced that they alternate with the rotating discs on the shaft but are not in contact with them. The casing is filled with water which acts as a drag and tends to rotate the stationary discs and hence the casing. The tendency to rotation can readily be determined by placing weights upon an arm attached to the casing from which the power of the turbine or other motor may be found by the usual methods. The temperature of the water may be regulated as desired by controlling the flow through the dynamometer.

All of the preceding dynamometers absorb the power delivered to them; in order to transmit the power from a prime mover or other source, to a machine or group of machines, some form of *transmission* dynamometer must be used.

Morin, one of the early users of dynamometric apparatus, gave as the requirements of a dynamometer the following:

"First. The sensibility of the instrument should be proportioned to the intensity of efforts to be measured, and should not be liable to alterations by use. Second. The indications of flexures should be obtained by methods independent of the attendance, fancies or prepossessions of the observer, and should consequently be furnished by the instrument itself, by means of tracings, or material results, remaining after the experiments. Third. We should be able to ascertain the effort exerted at each point of the path described by the point of application of the effort, or, in certain cases, at each instant in the period of observations. Fourth. If the experiment from its nature must be continued a long time, the apparatus should be such as can easily determine the total quantity of work expended by the motor."

To meet these conditions Morin made the spring-dynamometer, in order to obtain the magnitude of a force, as for instance, the traction of a horse on a loaded wagon or canal-boat.

In this dynamometer a force was measured by the flexure produced by it on two springs connected at their ends and loaded in the middle. The force is applied at the centre of spring, and its magnitude is determined by the increase of the distance between the two springs when one of them is attached to its load at the centre. In order to meet the second, third and fourth requirements Morin designed a self-registering recording dynamometer, by which the work performed was traced upon a continuous roll of paper set in motion by suitable wheelwork. Such dynamometers are in use at the present time to determine the tractive efforts of animals or gas tractors in the field or with loaded wagons on roads of different character.

When required to determine the force of rotation of a shaft or pulley this form of dynamometer requires modification; the essential features, however, remain the same. In this case a pulley, free to rotate on a shaft, is connected to it by means of two parabolic springs which are fastened to the shaft and also to the rim of pulley. These springs turning with the shaft deflect more or less, according to the resistance encountered, and when the resistance to bending overcomes the resistance of the machine, motion is transmitted through the springs to the pulley and thence to the machine under load.

Using the same notation previously given, and substituting R — radius in path in feet — for, L the work done is $W = 2 \pi RNP$; where P = resistance overcome in the machine driven by the dynamometer. P can be readily ascertained when deflection of spring is known.

Another form of transmission dynamometer, sometimes called the differential dynamometer, has long been in use. In this machine it is assumed that it requires as much power to hold a weighted radius arm horizontal as it does to lift the same weight through the distance which would be traversed by it in any given number of revolutions if rotated in the circle and in the time required for such number of revolutions. This it will be seen is similar in principle to the method used in determining power by means of any friction brake, or absorption dynamometer; but while the latter absorbs the power, the differential dynamometer measures or weighs the power transmitted through it.

Still another form of transmission dynamometer by which the tendency to rotation is weighed is that designed by Prof. S. W. Robinson. This machine consists essentially of a supporting frame, or pedestal, a T-shaped arm carrying the driving mechanism, and a graduated scale or weighing apparatus. In use, the lower pulley of the dynamometer is belted to the machine to be tested, while a second belt connects the upper pulley with the one on the power shaft. The two pulleys of the dynamometer are mounted on a strong cross-tree bar so that they both overhang and can be

swung around to any position. These pulleys have each a gear on the end of the hub, both of which mesh into a smaller gear between, the latter being supported on a pin made fast as a crank-pin in an arm attached to a shaft which passes through the centre of the hub of the cross-tree. To the opposite end of this shaft the poise-bar is made fast by a set screw in a boss to which the poise-bar is secured. As work is transmitted from one pulley to the other through the intermediate gear on the crank-pin, the latter will be thrust to one side with a force proportional to the effort transmitted; this tends to tip the poise-bar which is prevented by adding weights. The equilibrating weights on the poise-bar, together with the speed, furnish data for calculation of the work being transmitted.

The Briggs and Tatham dynamometers are well-known forms of belt dynamometers but these are now seldom used since in most forms of belt dynamometers there is a tendency of the belt to produce excessive vibration at high speeds which causes very irregular readings. Notwithstanding this disadvantage, the belt dynamometer may be very satisfactorily used in certain cases.

It is quite feasible to measure the power transmitted to a machine or given out by a motor by supporting the machine upon trunnions and directly weighing its turning effect. This method of supporting a machine on its trunnions and determining its torque has been utilized by the Sprague Electric Works in the design of an electric dynamometer, for testing automobile and other motors, which consists of an electric generator supported on its bearings and connected by a flexible coupling to the motor to be tested. The pull is weighed directly on a scale-beam which can be calibrated with great accuracy. By weakening the field of the dynamometer the speed of the engine under test and the dynamometer can be varied and in this way values obtained for plotting the power curve of the engine. With this form of dynamometer it is possible to return the generated energy into the shop line instead of wasting the power as is usual with dynamometer work. It is to be noted that in this machine the electrical readings have nothing to do with the measurement of power. In this respect it differs from an ordinary electric motor which may be used as a dynamometer with a very high degree of accuracy, where suitable current is available, provided the motor be properly calibrated and the efficiency factor thus obtained used in determining the power transmitted to the machine to be tested.

In the Brackett cradle dynamometer the torque is determined by suitably mounting the machine to be tested upon a swinging platform suspended from knife-edges and supplied with a scale-beam and sliding weight; the tendency of the driving belt to rotate the machine may be weighed on the scale-beam, and this will give a measure of the power when the speed is known. This dynamometer consists essentially of a strong stiff platform, furnished with two rigid uprights carrying steel knife-edges from which the platform is suspended. These knife-edges rest upon firm supports bolted to the floor and so constructed that a slight swinging motion is allowed to the platform upon which the machine to be tested is mounted. To one of the swinging uprights, near the knife-edge, is fixed a graduated horizontal lever which carries a sliding weight. Adjusting screws are provided, by means of which the axis of rotation of the armature of any given machine may be made to coincide with the axis of oscillation of the cradle, viz., the line which passes through the two knife-edges. In this way machines of various makes and sizes can readily be put in position and their data determined. It is obvious that the cradle dynamometer can be used to measure the work absorbed by any machine which can be conveniently mounted on the swinging platform.

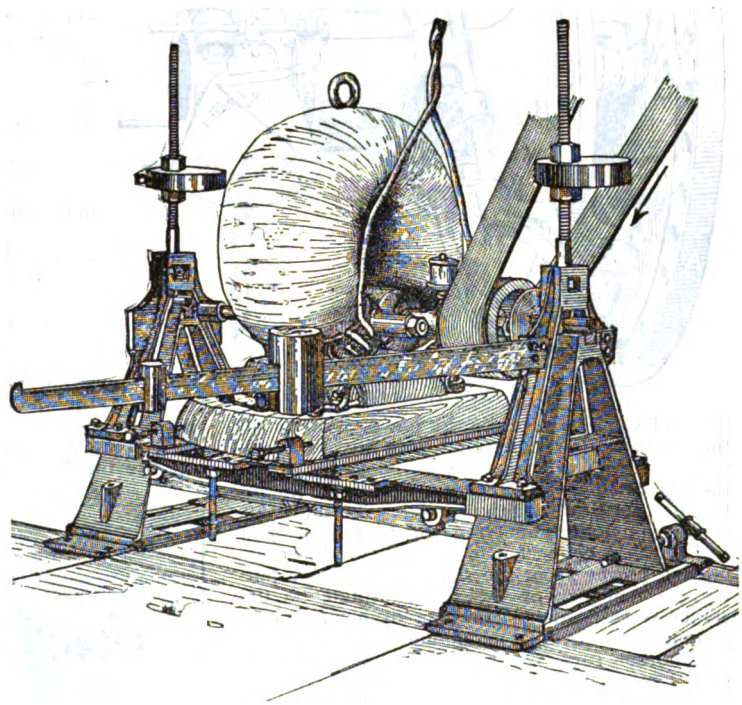

FIG. 6—Brackett Cradle Dynamometer.

Among other forms of dynamometer not already discussed is the Emerson power-scale—an instrument which is connected directly to the revolving shaft without the interposition of belts, except that used to drive the shaft itself. The machine in principle is a rotary scale, and its construction closely resembles the well-

known Fairbanks platform-scales. This dynamometer is largely used in cotton-mills to determine the power consumed by the individual machines, and when used with care forms an excellent instrument for the purpose, being self-contained and readily applied. In this machine

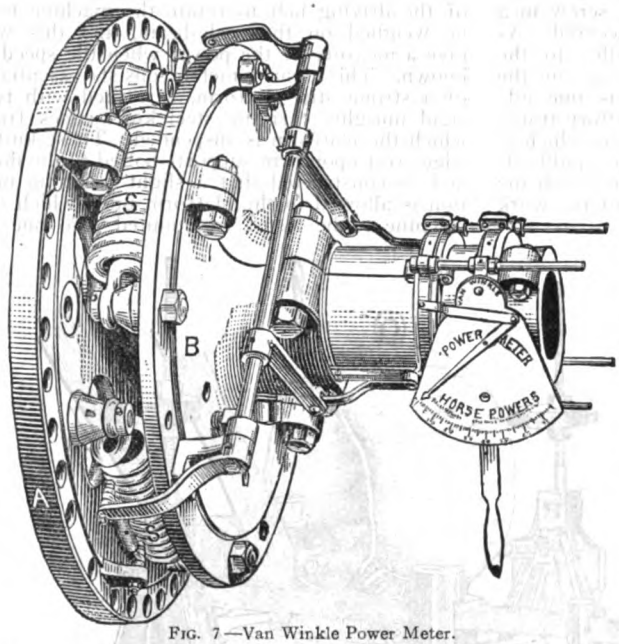

FIG. 7.—Van Winkle Power Meter.

the pulley which receives the power is loose on the shaft, and is connected with the latter by means of a spider which is keyed to the shaft, the hub of the spider forming one of the guides to the position of the pulley. Around this spider is a loose rim from which studs project and serve to connect it to the pulley. In transmitting power from the shaft to the loose pulley the tendency of the rim to rotate on the spider is resisted by a system of levers which communicate with a pendulum balance-weight.

Another form of shaft-dynamometer is the power meter devised by Franklin Van Winkle. This is a rotary transmitting dynamometer shown in Fig. 7, in which helical pull-springs are employed for weighing the amount of force transmitted from the driving to the driven portion of the dynamometer. This instrument is especially adapted for adjustment to any shaft or pulley for measuring power transmitted by a shaft to a pulley, or vice versa, in this respect resembling the Emerson power-scale.

A portable dynamometer capable of giving a continuous autographic record, designed by the writer with especial reference to the measurement of power required to drive machine tools, is illustrated in Fig. 8.

In its latest form, this machine consists essentially of three pulleys carried by a hollow shaft which runs upon roller bearings mounted on a stiff frame as shown. The pulley on the right is fixed to the shaft and may be used for the belt which connects the dynamometer to the machine to be tested, or it may be used for a brake-band; the middle pulley is an idler and runs loose on the shaft; while the one to the left receives the driving belt and is free to turn only within given limits. This latter pulley is connected to the shaft through the hydraulic cylinders and cylinder carrier. The cylinders and shaft are filled with oil, so that any resistance to turning produces a pressure in the cylinders. This pressure is transmitted by the oil through the hollow shaft, and is recorded by the movement of an indicator-piston which is fitted into the end of the shaft; the pressure is also shown by the gauge at the opposite end. In addition to the force curve traced by the indicator pencil, the zero or datum line is traced by another pencil which is adjustable in position and may be located at pleasure on a line parallel with the axis of the shaft. Thus one is enabled to measure the total power required to run a given machine or any subdivided part of it. Springs of various intensities are used to transmit the pressure from the shaft to the indicator pencil, depending upon the pressure to be recorded. These springs are changed as in any ordinary steam engine indicator. One of the interesting features about this machine is its adaptability to either transmit or absorb power. In either case an autographic record is traced upon a roll of paper which can be stopped or started at pleasure.

An examination of a diagram from this dynamometer shows that the power required to drive the machine empty can readily be determined if desired, for all that is necessary is to run the machine at the same speed without

FIG. 8.—Flather Transmission and Absorption-Dynamometer.

any pressure on the cutting tool, and the resulting diagram will give a measure of the work. The same is true of the power required

to operate the feed mechanism of the machine, or the dynamometer itself. The actual value of the power is obtained by methods which will be obvious.

For many years the attention of engineers and power users has been directed to the practicability of using the twist or torsion in a shaft as a means of determining the horse power transmitted by it. When power is applied to one end of a shaft the amount of twist varies directly as its length, directly as the moment of the applied load, inversely as the rigidity of the material, and inversely as the fourth power of its diameter all of which is expressed in the formula: $\theta = \frac{32}{\pi} \frac{M_t L}{G D^4}$, or, for hollow shafts $\theta = \frac{(32)}{\pi} \frac{M_t L}{G(D^4 - d^4)}$ in which θ = the angular displacement in radians, M_t = twisting moment in inch-pounds, L = length of shaft in feet, G = the modulus of rigidity, or modulus of transverse elasticity, D = outside diameter of shaft and d = inside diameter if hollow, both taken in inches. Various methods have been developed for determining the magnitude of the twist in the shaft by means of torsion metres or torsion indicators, most of which have been designed with especial reference to marine service. The rapidly increasing use of steam turbines in ships and the necessity of determining the power of the turbines — for which the steam engine indicator is not adapted — has created a demand for an accurate, easily operated torsion dynamometer, since the use of some form of torsion meter is the only known method of obtaining the desired information. The principle of operation in general consists in the observation of the twist between two given points on the shaft and this has been frequently accomplished by means of beams of light in combination with rotating discs; in other cases electrical observations are used to determine the distortion: in any case the horse power is obtained from: H. P. = $\theta \frac{D^4 N}{CL}$, in which θ is the angle of twist in degrees, D = diameter of shaft in inches, N = revolutions per minute, L = length of shaft in feet between which θ is determined, and C = a constant depending upon the modulus of transverse elasticity, and other numerical factors.

It should be noted that tensile tests and percentages of elongation of the metal are of little use in obtaining the transverse modulus of elasticity. This modulus may vary in apparently identical shafts all the way from 11,500,000 to 12,500,000 so that in order to obtain accurate results the modulus for each shaft must be separately determined.

The Bevis-Gibson flashlight torsion meter will serve to illustrate the general method of determining the power exerted by a propeller shaft. Two blank discs are mounted on the shaft at a convenient distance apart. Each disc is pierced near its periphery by a small radial slot, and these two slots are in the same radial plane when no power is being transmitted and there is no twist on the shaft. Behind one disc is fixed a bright electric lamp masked, but having a slot cut in the mask directly opposite the slot in the disc. At every revolution of the shaft therefore a flash of light is projected along the shaft toward the other disc. Behind this disc is fitted the "torque finder," an instrument fitted with an eyepiece and capable of slight circumferential adjustment. The end of the eyepiece next its disc is masked except for a slot similar and opposite to the slot in the disc. When the four slots are set in line, a flash of light is seen at the eyepiece every revolution, and if the shaft revolves quickly enough the light will appear to be continuous. This effect is apparent at anything over 100 revolutions per minute. At lower speeds the flash is seen to be intermittent, but this in nowise affects the accuracy and reliability of the result. At each end of the shaft section, therefore, there exists what is virtually an instantaneous shutter fixed directly to the shaft, and the only connecting link between the discs is the beam of light which flashes once in each revolution clear through the two shutters. Suppose the shaft to be transmitting power. One disc lags behind the other by a definite amount, and although three of the slots are still in line the one in the lagging disc is not in line and

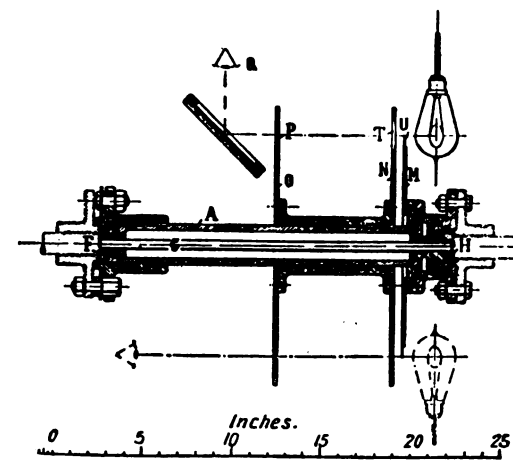

FIG. 9—Torsion Dynamometer.

therefore effectually breaks the flash and no light is seen at the eyepiece. To pick up the light again the eyepiece of the torque finder must be moved by an amount equal to the circumferential displacement of the lagging disc. This is accomplished by manipulating the micrometer of the torque finder on which is a scale and vernier graduated in degrees. While the scale is fixed its vernier moves with the eyepiece, and the graduations are so marked that by the aid of a simple microscope conveniently hinged, differences of 1/100 of a degree can be readily discerned. For shafts of ordinary size the scale is set at 14.325 inches radius from the centre of the shaft, so that the degrees are ¼-inch apart. Since an ordinary shaft twists 1 degree in 10 feet at full power it is quite possible to get the shaft horse power to within 1 per cent of full power; but as it is frequently possible to fit the discs 40 or 50 feet apart even this accuracy may be improved upon, and the power determined to within ¼ of 1 per cent of full power.

One type of the torsion dynamometer described by Amsler is illustrated in Fig. 9. In

this form it is intended to be coupled directly by its flanges between the driving and driven shafts. It is also made, however, to receive and transmit its power by belt, in which case the dynamometer is provided with a belt pulley at each end. The two flanges are coupled together by a central shaft G capable of transmitting all the power without being stressed beyond its elastic limit. The flange at the end H carries a disc M, to the outer edge of which an engraved celluloid scale U is attached. From the flange at the end F a tube A extends toward the other end and is carried by a ballbearing within the flange at H. This tube carries two discs N and O, in each of which slits T and P are cut. A lamp is hung behind the scale and a mirror may be arranged, as shown, to facilitate the reading.

It will be understood that when the shaft twists under the influence of the power transmitted the scale U moves relatively to the line through the slits PT. With each revolution of the shaft, therefore, a momentary glimpse of the scale division is seen by the eye at Q as the slits PT cross the line of sight. If the speed be sufficiently great and the torque constant, a continuous impression is received of a given scale division. This reading, in conjunction with the speed, gives data from which the power being transmitted is calculated. This type of dynamometer is usually made for speeds of about 4,500 revolutions per minute; it has, however, been used in cases where the speed was as high as 8,500 revolutions.

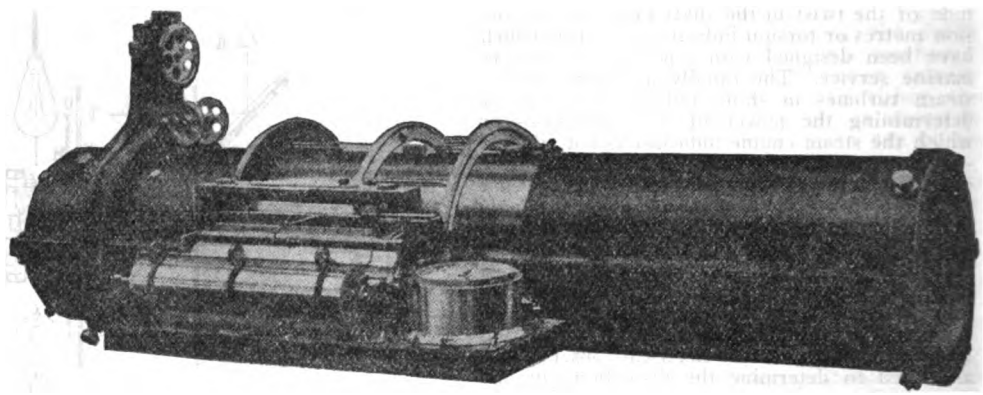

FIG. 10—Denny-Edgecombe Indicating and Recording Meter.

In the torsion dynamometers just described the measurement covers the average angular displacement for a given load with fair accuracy but it is obvious that where reciprocating engines are used, and even with steam turbines, the torque undergoes various changes in a complete revolution; this is especially so when the shaft carries a propeller, in which case the complicated fluctuations cause irregular oscillations in the angle through which the shaft is twisted. To determine these variations in twist throughout a revolution various modifications of the torsion meter have been employed, by which instantaneous readings are obtained throughout a revolution. Several types have been arranged to record the twist graphically. Among these the Denny-Edgecombe torsion indicator merits attention. This instrument, Fig. 10, consists of a cast-iron sleeve made in two sections and cast in halves so that it can be bolted together around the shaft; the head section, or so-called stump, is provided with a standing arm and is securely bolted to the shaft and turns with it. The tube section carries a corresponding standing arm which is free to rotate relative to the fixed arm within the limits of the angle of twist, the other end of the tube being fixed to the shaft. When the shaft is twisted the sleeve remains untwisted, so that the twist produces a relative but small movement between the arms of the stump and sleeve. This movement is multiplied by means of gearing at the end of the arms, and converted into longitudinal motion of a light aluminum traveler adjusted to run upon the outside of the sleeve. This is accomplished by a flexible wire rope which passes around a pulley connected to the shaft and secured at both ends to a drum on the multiplying gear; the traveler is also securely fastened to the wire. All the wheels and pulleys are mounted on ball bearings, and are practically frictionless, so that when the shaft is revolving the ordinary vibration insures accuracy of position. The flange of the traveler is thus made to move along the tube by the twist imparted to the shaft. If this were measured directly, however, the result would be subject to serious error, for there always is some longitudinal movement of the shaft itself due to thrust or expansion. This is eliminated by means of a turned base or dummy flange cast upon the sleeve. The traveler flange is made to fit accurately against this base flange for setting in position, and is then drawn along the tube and secured to the wire rope at a convenient distance from the base flange. The variation of distance between these two flanges will thus be an exact measure of the variation of torsion of the shaft.

An indicator is applied to these two flanges to further magnify the movement and make it easily readable. If it be desired to obtain a permanent diagram, a recorder may be attached to the front of the indicator. This recorder has drums which are driven by means of small double-worm gears from the spindle of the wheel which runs on the base flange. Change gears, actuated by a small lever, are provided, so that the drums can be kept revolving in the same direction whether the ship is going "ahead" or "astern." A diagram paper is thus made to move with the drums, upon which pens attached

to the fixed scale and to the movable rack, mark respectively a zero line and a torsion line. In addition to this a clock is fitted with an electrical arrangement for marking half seconds and another pen is provided which can be connected electrically with a make-and-break fitting on the revolution counter of the engine; a diagram of simultaneous revolutions per minute and torsion is thus obtained.

Another form of the Denny-Edgecombe torsion meter, especially useful for marine service with turbine or reciprocating engines, operates by transferring the movement electrically to an ammeter which may be fitted up in the engine room or in any part of the ship. Duplicate ammeters may also be fitted so that it is possible to read torsioin simultaneously in the engine room, the chief engineer's cabin and captain's cabin. The instrument is a robust electro-mechanical combination which is as simple to read as a pressure gauge. By pressing a button the torsion of the shaft may be read immediately and the corresponding shaft horse power obtained from tables or charts.

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DYNAMOTOR. See MOTORS AND DYNAMOS.

DYNE, dīn (Gr. "power"), the unit of force in the centimeter-gram-second system of units. It is defined as the force that must be exerted upon a gram of matter for one second in order to give it an acceleration of velocity of one centimeter per second. The attractive force that the earth exerts upon a milligram of matter is somewhat different in different latitudes, but for the sake of illustrating the order of magnitude of the dyne, it may be said that at the latitude of New York a body falling freely acquires an acceleration of 980.266 centimeters per second. Hence the force of gravity at New York is equivalent to 980.266 dynes per gram of weight; that is, 444,641 dynes per pound. For many purposes the dyne is too small a unit for convenience, and a larger unit, called a "megadyne" and defined as equal to 1,000,000 dynes, is often used in its place. It is commonly expressed in the form, 10^6 dynes. In the English system of foot-pound-second notation, the unit of force that produces an acceleration of one foot per second upon a mass of one pound, known as the foot-pound (or in some textbooks as the "poundal"), is the equivalent of 13,825.5 dynes. See FORCE; UNITS OF MEASUREMENT.

DYRRHACHUIM, dĭr-rā'ki-um. See DURAZZO.

DYSART, dī'zärt, Scotland, seaport in the county of Fife, on the Firth of Forth; 28 miles northeast of Edinburgh by rail. Dysart possessed great importance in the 15th century, and was famous for collieries and salt-works. Shipbuilding and linen weaving are among the industries. Pop. 3,022.

DYSENTERY, a general term connoting a series of diseased conditions of the large intestine or colon (q.v.). These may be of an infectious, nervous or chronic inflammatory origin. At the present time, it is becoming recognized that most cases of dysentery are due to different micro-organisms, and within recent years a bacillus has been described by a Japanese observer, Shiga, which is thought to be responsible for a number of the cases of dysentery, both in adults and in children. Certain mild cases of dysentery have been shown to be dependent upon the pernicious activities of certain bacteria belonging to the genus *Proteus.* And it has now been known for a long time that a certain lowly organized animal form, the *Entamoeba,* can induce a peculiar type of dysentery known as amœbic dysentery. Thus the dysenteries may be divided into (1) Animal parasite dysenteries: (a) Protozoa; (b) Plathelmint, Schistoma, etc.; (c) Nemathelminth; (d) Arthropods. (2) Bacterial dysenteries.

The general mode of onset of dysentery of the non-amœbic form, that is particularly epidemic dysentery, is rapid, with diarrhœa following perhaps a mild constipation or alternating constipation and diarrhœa with a mucous or serous discharge. Symptoms of indigestion frequently precede the attack, and it is characteristic that diarrhœa is accompanied with much wind. The fæcal movements are large, loose, very fetid and usually mixed with blood and mucus. The movements are accompanied with great pain of a colicky or gripy nature. Tenesmus, or straining, is a very frequent symptom. There is usually much general pain, some rise in temperature, loss of appetite, nausea, restlessness and irritability. In favorable cases formed fæces commence to reappear in the stools and there is disappearance of the griping and straining. In the patients in whom the disease becomes more acute, the passages become looser, watery, slimy and of a dark red color. The odor is mawkish, and in later stages may even become putrid. The fluid that is passed consists largely of an albuminous serum with epithelium blood cells, pus cells, tissue fibres and small sloughs, and if the disease becomes even more pronounced the stools become dark brown in color, with sloughs and blood clots, and have a distinctly gangrenous odor. These sloughs from the intestine usually indicate an extremely severe form of the disease and ofttimes the patient dies with completely relaxed anus, with subnormal temperature, shrunken features and in complete collapse.

Amœbic dysentery is, as a rule, a more gradual form of disease. It is extremely intermittent in its course and much protracted, running on sometimes months and even years. It very frequently begins with painless diarrhœa, alternating with constipation; the stools being loose and yellowish, containing much mucus and a little blood. The patient commences to lose flesh, becomes weak and anæmic, and the complication of abscess of the liver is extremely common. Chronic dysentery is a form of chronic colitis and can be found under that head. The treatment of dysentery consists in rigid hygiene and skilled medical attendance, as the different type of parasites must be recognized by the microscope and appropriate remedies for each type administered. See AMOEBA; CHOLERA; COLITIS; ENTERITIS; ENTEROCLYSIS; INTESTINE; PARASITISM AND ANIMAL PARASITES.

DYSLYSIN (Gr. "hard to dissolve"), an amorphous, resinous substance, having the formula $C_{24}H_{36}O_5$, and obtained from cholalic acid

by heating to about 600° F. or by prolonged boiling with dilute hydrochloric or sulphuric acid. It is soluble in ether, slightly soluble in boiling alcohol and insoluble in water; and it is reconverted into cholalic acid by boiling with an alcoholic solution of caustic potash. It is found in small quantities in the contents of the large intestine of herbivorous and carnivorous animals, and also in their fæces, being in such case the result of bacterial processes upon the cholalic acid of the bile.

DYSMENORRHŒA, dĭs-mĕn-ō-rē'a, painful menstruation. To constitute dysmenorrhœa, the pain accompanying menstruation should be very distinct and persistent. Inasmuch as dysmenorrhœa is found accompanying a vast variety of abnormal conditions of the uterus and ovaries, it seems not improbable that this affection has various pathologies, but may be associated with almost any abnormal condition within the generative apparatus of women. A vast variety of forms of dysmenorrhœa have been described, the most important of which seems to be that of obstructive dysmenorrhœa, or a mechanical form supposed to be due to some interference in the escape of the menstrual fluid. Those who suffer from dysmenorrhœa are apt to be anæmic, which anæmia in itself may be a sufficient cause for the disease. They are apt to be extremely nervous and run down. Many cases of dysmenorrhœa are psychic in origin, how great a proportion it is impossible to say, but probably 25 per cent. A large group are due to under developed organs. Here endocrinous gland disturbances are to be found. Treatment should be directed to the supplying of the deficiency of the iron in the blood to overcome the anæmia, and the use of cod liver oil and other reconstructives for the anæmic forms and proper psychotherapy for the psychogenic types. The endocrinous types need internal glandular or opotherapy. Pronounced ovarian disease, usually found only in older patients, requires surgical therapy. Of the various drugs that have been used for the temporary treatment of dysmenorrhœa those that relax muscular fibres and arterial walls seem to give the best results. This is true of a number of the newer synthetic drugs that have been employed very widely of late. As no two cases of dysmenorrhœa are due to precisely the same cause, general directions for treatment would be out of place in a work of this character, but rest in bed, free movements of the bowels and hot water in the form of hot-water bags, or hot-water enemata, are very useful household remedies. See MENSTRUATION; OVARY; WOMB.

DYSON, Edward, Australian poet: b. Morrison's Diggings, 4 March 1865. He has been in journalistic work since 1883. Among his published works are 'Rhymes from the Mines' (1896); 'The Golden Stanty' (1898); 'Below and on Top' (1898); 'The Gold Stealers' (1901); 'In the Roaring Fifties' (1906), and 'Fact'ry 'Ands' (1907).

DYSPEPSIA is that combination of symptoms that results from interference with the proper digestion of food in the stomach. Because of the taking of too much food or unsuitable food, the mucous membrane of the stomach becomes irritated and there is set up an acute or subacute gastric catarrhal condition which prevents the proper digestion of the food. This food is apt to ferment and to decompose, and as a result the familiar picture of acute dyspepsia may arise. In mild cases there may be nothing more than an uncomfortable feeling in the stomach, with a certain amount of depression, headache, loss of appetite and perhaps belching of wind and occasionally vomiting. There may also be accompanying intestinal symptoms, such as diarrhœa and colic, particularly in children. There may be only the familiar heartburn, due to the over-dilatation of the stomach, from the excessive gases of fermentation or putrefaction. In the more severe cases, those that last over a day or two, the symptoms enumerated may be much more intense. The distress may be marked, and the general constitutional symptoms more evident. Vomiting, loss of appetite and mental depression are much more pronounced. This is particularly true of acute gastritis, due to the excessive use of alcohol.

Very frequently, from continued errors in diet, the acute or subacute condition may become chronic, so that there is a continual indigestion. Here the symptoms persist for an indefinite period, the appetite is very apt to be variable, although at times very good. Oppression after eating, which may amount to actual pain, is one of the most constant symptoms. Occasionally the pain may be pronounced when the stomach is empty. Heartburn is frequent, if not constant, the stomach is painful on pressure, the tongue is coated, there is bad taste in the mouth, there are changes in the amount of salivary secretion. Frequent belching of gas is a very common accompaniment of chronic dyspepsia, particularly of the flatulent variety. Here also the intestines suffer from distention. Nausea is more pronounced, particularly in the morning hours, and vomiting is common in the morning. Constipation is usually present, although diarrhœa may alternate with constipation, and mental depression is almost characteristic. The treatment of acute and chronic dyspepsias constitutes one of the most difficult problems in modern medicine, particularly as few patients are willing to undergo the ordeals of a rigid dietary regimen. Most cases of dyspepsia can be cured if the diet is looked after, although each case needs careful consideration from the standpoint of causation. Proper eating and proper amounts of food are the two most important features in the treatment. Most people eat too fast and eat too much. If the food is taken slowly, observing the old-fashioned rules of counting between mouthfuls and small amounts are taken, many patients suffering from indigestion can treat themselves with success. More than one-half of the dyspepsias are really mental in origin. They are produced by worry and by impatience, and are best treated by proper psychotherapy. One group of recurring dyspepsias which come on in attacks lasting a few weeks or a few months, with slight depression, are mild forms of a manic-depressive psychosis. These are amenable to psychotherapy also. They get well by themselves, but are apt to recur without proper therapy. As to the details of the dietary and as to the medicinal treatment of the condition, medical advice is absolutely necessary.

One of the most pernicious of all practices in the treatment of dyspepsia is the taking of many of the patent medicines which are so blatantly advertised in the religious and lay press. As most of these so-called tonics are hardly more than alcoholic beverages, it is evident that their use is not unattended with a great deal of danger. The treatment of the constipation that is so frequent an accompaniment of chronic dyspepsia by means of the many patent pills, powders, teas and liquids is positively suicidal. See CONSTIPATION; ENTERITIS; GASTRITIS.

DYSPHONIA, roughness of sound; in pathology, a difficulty in speaking. The disorder known as "clergyman's sore throat" is a common example. Rest of the vocal organs, tonics, muscular exercise, change of scene, are generally needed to aid recovery.

DYSURIA, dĭs-ū'rĭa, difficult or painful urination, a symptom of temporary disorder, or of deep-seated disease. When dysuria is merely the result of a slight cold it can often be relieved by a dose of sweet spirits of nitre or linseed tea. Sometimes this symptom is the result of a stricture, or it may be caused by gravel, or stone, in which case the services of a physician should be obtained, and that without delay.

DYVEKE, dü'vĕ-kĕ, mistress of Christian II of Denmark: b. Amsterdam, 1491; d. 1517. She was the daughter of an innkeeper at Bergen and Christian met her for the first time in the inn of her father. She accompanied the king to Denmark in 1507 and was constantly with him for the 10 years following. She is one of the most romantic figures in Danish history and has frequently been celebrated in poetry and fiction as the victim of royal passion and the insane jealousy of the nobility, who resented her exaltation. She was poisoned by her enemies, but Christian allowed her mother to remain at court as his chief counselor for the remainder of his reign.

DZEREN, dzē'rĕn, the "goitred" yellow antelope of China (*Gazella* or *Procapra gutturosa*), with unusually pale horns and a protruding goitre-like crop in the males during the rutting season. It is indigenous to the deserts of Central Asia, China and Tibet, and is noted for its fleetness. The name "dzeren" is Mongolian.

DZIGGETAI, dzig'ge-tī, the native name for the Mongolian wild horse or wild ass (*Asinus* or *Equus hemionus*), also known as the Kiang (q.v.), and sometimes compounded with the Kulan (*Equus* or *Asinus onager*).

E

E the fifth letter of the English alphabet, as also of the alphabets of Greek and Latin, and of all the European languages except those which, as the Russian, use the Cyrillian alphabet, where the E has sixth place The character corresponding to E in Hebrew and other Semitic languages, as Phœnician, Samaritan, Chaldæan, holds the same relative place in the alphabets of those languages. The form of the letter *e* in early Hebrew and early Phœnician was 𐤄 and from that is derived the Greek E (epsilon), which is the Phœnician character reversed, with stem shortened and made perpendicular: this character represented in the Hebrew and other languages of western Asia, not the vowel sound E but the soft breathing. Taken into the Greek alphabet it was at first used to represent the vowel sound *e* whether short or long; but afterward the character H was employed in Greek for the long *e* and was called *eta*, while the E received the name *epsilon*. The Latins used the E for both the long and short vowel and adopted the H of the Greek alphabet to denote the aspirate. The name and sound of this letter in all European languages except English is *eh*, as in our interjection of inquiry: long *e* in those languages is invariably equal to *a* in *mate*, and short *e* equal to *e* in *met:* the long E of English is in those other languages expressed by the third vowel, I: thus, English *he, me, lee,* would in those languages be written phonetically *hi, mi, li.* In the standard alphabet employed in linguistic science the vowels *a, e, i, o, u,* are taken to represent the sounds *ah, eh, ee, oh* and *oo,* and are named accordingly. The letter E occurs in English words far more frequently than any other letter of the alphabet: compared with A, I, O, U, its frequency of occurrence is as 1,000 to 728, 704, 672, 296 respectively; compared with various other letters it is as 1,000 to 770 (*t*), 670 (*n*), 392 (*d*), 280 (*c*), 236 (*f*), 120 (*b*), 22 (*z*). In frequency of occurrence as an initial letter it ranks only as eleventh and is to T as 340 to 1,194. One reason of the greater frequency of E in general use is that it often takes the place, in modern English words, of the vowels *a, o* and *u* of Anglo-Saxon words; another reason is that final *e* is largely employed to lengthen the vowel of a preceding syllable, as in *there, here, cape, pane:* it is employed even where it serves no purpose of pronunciation at all, as in *gone, live, give.*

E as an abbreviation is used for East, *editio, emeritus,* and *ergo;* e.g. and e.c. for *exempli gratiâ,* and *exempli causâ.*

In music E is the third tone in the key of C, and the fifth semitone in the chromatic scale. Consult Soames, ''Introduction to the Study of Phonetics,' and Sweet, 'History of English Sounds.' See ALPHABET.

E. C. SPORTING POWDER is a superficially hardened, soft-grained, smokeless sporting powder, consisting, according to an analysis by C. E. Munroe, of 53.57 per cent of soluble cellulose nitrate, 1.86 per cent of insoluble cellulose nitrate, 3.12 per cent of unconverted cellulose, 34.26 per cent of barium nitrate, 4.55 per cent of potassium and sodium nitrates, 1.17 per cent of volatile matter, and 0.55 per cent of aurine, the latter being an organic coloring matter, used to impart an orange color to the grains. The manufacture, as carried out by the Explosives Company, after the method invented by Reid and Johnson, consisted in placing the moistened, pulped cellulose nitrates and metallic nitrates in "barrels" where, by rotation, the ingredients were mixed and then broken up into rounded grains, which were dried and then sprayed with ether-alcohol which at first gelatinized the surfaces of the grains, and then by evaporation left a hard skin about the grains. The coloring matter was added in the solvent. The grains are then dried and passed through a sieve in order to separate any grains which have stuck together during the gelatinizing process. No. 2 E. C. powder contains a little camphor and is treated throughout the graining with ether-alcohol. This results in a harder and denser powder which burns more evenly and yields a higher velocity than No. 1 powder.

E PLURIBUS UNUM, ē ploo'rĭ-bus ū'nŭm ("one from many"), the motto of the United States; chosen for its Great Seal 10 Aug. 1776, by Franklin, Adams and Jefferson, as a committee. It has been part of the motto of the *Gentleman's Magazine,* founded 1731; apparently taken by it from a sentence in Virgil's (?) 'Moretum,' "color est e pluribus unus."

EADMER, or **EDNER,** a mediæval church man, historian of his own times and biographer: he flourished in the 11th and 12th centuries; d. Canterbury, about 1124. He was a Benedictine monk and was the companion, counsellor and friend of Saint Anselm, Archbishop of Canterbury, whose life he wrote. He held a like relation to Saint Anselm's successor, Radulphus, or Ralph, till 1120 when, invited to Scotland by King Alexander I, he was nominated bishop of Saint Andrews; but went back to his monastery because of a controversy having arisen over the king's right to nominate and the pretensions of the archbishops of Canterbury to primatial jurisdiction over the bishops of Scotland, which pretensions Eadmer upheld. He was even wont to say that he would refuse the highest see in Scotland if he must divest himself of his character as a monk of Canterbury. He wrote 'Historia Novorum,' that is, history of recent occurrences of his own times. Besides the life of Saint Anselm he wrote the lives of three of

Anselm's predecessors in the primatial see — Saint Odo, Saint Dunstan and Saint Bregwyn; also the lives of Saint Wilfrid and of Saint Oswald of York; all of which writings have been printed in Wharton, 'Angla Sancta.' Consult Grub, 'Ecclesiastical History of Scotland' (Edinburgh 1861).

EADS, ēdz, **James Buchanan,** American engineer: b. Lawrenceburg, Ind., 23 May 1820; d. Nassau, New Providence, 8 March 1887. He began as a clerk in a dry-goods house in Saint Louis in 1833, and then secured work on a Mississippi steamboat in 1839. He early designed some useful boats for raising sunken steamers, and in 1861, when called to advise the Federal government, constructed within 100 days eight ironclad steamers for use on the Mississippi and its tributaries. He afterward built a number of other ironclads and mortar-boats, which were of considerable service to the North. He built an arch bridge across the Mississippi at Saint Louis 1867–74. His works for improving the South Pass of the Mississippi delta were successfully completed in 1875–79; and his great plan for deepening the river as far as the mouth of the Ohio by means of jetties has been demonstrated to be entirely practicable. A later suggestion, for the construction of a ship-railway across the Isthmus of Tehuantepec, attracted much attention. In 1884 he received the Albert Medal of the Society of Arts, being the first American citizen to whom this honor had been awarded. Consult How, 'James B. Eads'. (Boston 1900).

EAGAN, Charles Patrick, American military officer: b. Ireland, 16 Jan. 1841. In 1862 he entered the Union army as first lieutenant; in 1874 was promoted captain and commissary of subsistence; in 1892, major; in 1897, lieutenant-colonel; on 11 March 1898, colonel, and on 3 May, following, brigadier-general and commissary-general. In January 1899, he made remarks concerning General Miles, in his testimony before the War Investigation Commission, for which he was tried by court-martial and sentenced to dismissal from the army. His sentence was commuted by the President to suspension from duty and honors for six years. On 6 Dec. 1900, he was restored to duty and immediately afterward retired.

EAGLE, as a popular name, includes several raptorial birds which vary in some respects from the strictly defined group in which science has been wont to place it. The order *Accipitres,* to which it belongs, is broad enough in definition to include all the vultures, the typical eagles, and the buzzards. Recent osteological demonstrations, however, have led to the separation of American vultures from the Old World vultures, including the latter in the family *Falconidæ,* to which eagles and vultures belong. This family, which embraces 300 species of diurnal raptores, is characterized by imperforate nostrils, legs of medium length, and, except in the Old World vultures, a feathered head, a bill decidedly hooked, the hind toe inserted on a level with the three front ones, and the claws roundly curved and sharp. The sub-family *Aquilinæ* makes prominent the cutting edge of the upper mandible, the bony shield over the eye, the feet heavy and short, either scutellate or feathered. The Lämmergeier (*Gypaetus barbatus*), lamb-killer, or bearded vulture of the Alps, the Pyrenees, and the Himalayas, finds its nearest affinity here. The *Aquilinæ* are naturally divided into two genera: *Aquila,* land eagles, and *Haliaetus,* sea-fishing eagles. The former is feathered to the toes, the latter half way to the toes.

The leading specimen of *Aquila* is the golden eagle (*A. chrysaetus*) one of the largest and most magnificent of its kind, dark brown with purple gloss; head and neck brownish-yellow; tail rounded and dark brown, ending in light and dark tints. The length is about three feet, the extent of wing seven feet. In North America its range is from Mexico north. It is very scarce in the United States but more abundant in Canada, where it is distinguished as *canadensis.* It is regarded as a variety of the European species, which seldom occurs in England, though more prevalent in Scotland, where the demand for its eggs has favored its increase. The nest is usually placed on some inaccessible cliff, the eggs are spotted and do not exceed three. Closely allied to the golden eagle are the imperial eagle (*A. mogilnik*) of southwestern Europe and of Asia, and the king eagle (*A. hiliaca*) of the same range. The smallest of the kind is the dwarf eagle. (*A. pennata*) which measures less than two feet and is native in Southern Europe, North Africa and in India.

First in interest among the sea-eagles stands the bald-headed eagle (*Haliaetus leucocephalus*), selected as the national emblem of the United States. Its markings are familiar, though the term «bald» is to be referred not to the absence of feathers, but to the effect produced by the white feathers on the head. In size, it corresponds nearly to the golden eagle, but it differs in its habits, living mainly upon the fish which it seizes along the sea-shore and around lakes and rivers. The nest is built on a high tree top or upon a rocky cliff. A finer specimen than this is the northern sea-eagle (*Haliaetus pelagicus*) of northeastern Asia. It is conspicuous by its large form and bill, and by the contrast of its main color, brown, with the white of its shoulders, rump and tail. The African sea-eagle (*H. vocifer*) is a fish-eater, about half the size of the «bald-head,» remarkable for its color-markings, being white on the head, neck and breast, while the under parts and wing coverts are chestnut, and the upper parts are black or brown. Nearly related to the *Haliaetus* is the fishing-eagle (*Polioaetus ichthyætus*) of India and the East Indies, with extremely curved talons, and living entirely on fish. In countries bordering on the Mediterranean and ranging into India and Central Europe, is the serpent-eagle (*Circaetus gallicus*) with short toes, white, brown-spotted under parts, and dark brown upper parts. It feeds upon reptiles, which it kills and carries away, not eating the game on the spot, as do other eagles. A buzzardlike genus, *Helotarsus,* is represented in Southern Africa by *H. ecaudatus,* the short-tailed eagle, oramented with maroon and black plumage, and bright red, very short legs.

The buzzard-eagles include some species which command notice from their great size and powerful action which fairly entitle them to their name. South America, in the dense forests of the Amazon, is the habitat of the

Guiana eagle (*Morphnus guianiensis*) relatively small, but with a tail longer than that of almost any other species. The wings are short and rounded, adapting it to swooping down with great force upon its prey, rather than for lofty or prolonged flight. From southern Mexico through the forests of Brazil, the harpy-eagle (*Thrasaetus harpyia*) has its home, and for muscular power is scarcely surpassed by any bird of prey in the world. It is larger than the golden eagle, gray in color, with long crest feathers, a stout, vicious bill, and talons of extraordinary force and sharpness. Though rapacious and apparently destructive, the eagles are useful in killing many other birds which venture nearer to farms and human habitations, in reducing the number of injurious reptiles and small mammals, and in helping to preserve the balance of the animal world. From the most ancient times the eagle has been regarded as the emblem of might and courage. Its great power of vision, the vast height to which it soars in the sky, the wild grandeur of its abode, have likewise commended it to the poets of all nations. It was associated with Jupiter in Roman mythology and was used on the standards of several Roman legions, whence it has descended to the national ensigns of Germany, Russia and the United States. See BIRD, and consult authorities there given.

EAGLE, a gold coin of the United States of the value of 10 dollars, or £2 1*s.* 1*d.* sterling in British currency, the rate of international exchange. An eagle weighs 258 grains troy, 900 fine. It was first coined in 1795, in accordance with an act of Congress, dated 2 Jan. 1792. There are also half eagles (first coined in 1795), quarter eagles (first coined in 1796), and double eagles (first coined in 1849), of proportionate values.

EAGLE, Black, a term applied to the golden eagle, *Aquila chyrsaetus,* also to the young of the bald-eagle. See EAGLE.

EAGLE, Black, Order of, a Prussian order, founded by Frederick II in 1701. The number of knights in the order was originally limited to 30, exclusive of the princes of the blood royal; and unquestioned nobility used to be required of all members. The order is now conferred also for distinguished military or civil service. The badge is a Maltese cross of blue enamel having in the centre a circle with the monogram F.R. (for *Fredericus Rex*); the four arms are enameled red with the eagle of Prussia in black enamel between each two arms. It is worn on a broad ribbon of orange hung across the left shoulder, and it is accompanied by a silver star on the left breast. The eagle is also depicted on the star, with a laurel wreath, a thunderbolt and the same superscription.

EAGLE, Red, Order of, originally called Order of the Red Eagle of Baireuth, and also called Order of Sincerity; founded by the Margrave of Baireuth in 1705. The badge is an eight-pointed cross, having in the centre a medallion with a red eagle bearing the arms of the Hohenzollern family.

EAGLE IN ART AND SYMBOLISM. The Persians and other ancient nations such as the Assyrians and Egyptians all utilized the eagle's form in art. Xenophon tells us that eagles were on the Persian ensigns. The ancient armies of the Romans had the eagle carried as a standard, hence they used the term "eagle" to designate their legions. In the Greek mythology we find an eagle as attendant on Zeus; it held in its claws the god's lightning bolts (*fulmen*), and it was an eagle that carried off Ganymede on its wings. In ancient times the eagle was often considered as symbol of the soul's flight after death. In early Christian art the eagle was used to personify Saint John the Evangelist, with his wonderful divine vision and spiritual flights. Strange to say, the early Christians often adopted the pagan carved gems containing representations of the heavy-bearded Zeus and his eagle as symbols of God the Father and his Apostle, whether wittingly or not is matter for conjecture. One favored form in Christian iconography represents the Evangelist in human form but with an eagle's head.

When Rome became an empire the eagle's form was used in picturing an emperor's apotheosis. Probably for this reason Napoleon Bonaparte made prolific use of the majestic bird as a decorative motif in his palaces when he became emperor; in 1804 he adopted it as ensign for his victorious armies. The eagle to this day is almost inevitably present in war and triumphal trophies.

In America, the eagle has long since figured as symbol of the republic, and a ten-dollar gold coin is named after it.

In heraldry, the eagle became an armorial charge quite early (about the period of Charlemagne). For this purpose its appearance had to be considerably transformed. It took on a very attenuated form, the *displayed* wing feathers becoming few and distinctly separated, so that, depicted on the shield of a knight, its outline would be visible a long distance off. In this heraldic form, Germany, Austria, Prussia, France (as empire) adopted the eagle.

The double-headed eagle device is a *bearing* in Russian, Austrian and German arms. In the latter two cases the twin heads refer to the assumption of power, both east and west. This double-headed heraldic bird (*Doppeladler*) is held in such reverence by the Teutonic race as sometimes to figure "nimbed," that is with the Catholic halo surrounding each head. In Christian iconography a double-headed eagle represents Elisha, the prophet.

In ecclesiastical art the term "eagle" is applied to a piece of church furniture — the lectern (q.v.) (reading desk) of brass or carved wood in the form of an eagle with wings displayed to hold the Bible on its back. It represents, of course, Saint John the Evangelist. See LECTERN.

CLEMENT W. COUMBE.

EAGLE HAWK, or **HAWK EAGLE** is the name for a group of some rather small and some large raptorial birds, closely related to *Aquila,* and chiefly represented by the genus *Spizaetus.* They are beautifully crested and range in South Africa, Central and South America. A notable specimen is the crowned eagle (*S. coronatus*) of South Africa, of medium size, its under parts buff, banded with black, the head furnished with a crest of long, brown feathers. Of the same geographical range is a species of *S.* (*Lophoaetus*) *occipi-*

EAGLES

1 The Golden Eagle (Aquila chrysaetus)
2 The Black Eagle (Aquila melanaetus)
3 The Pomarine Eagle (Aquila pomarina)
4 The Oriental Eagle (Aquila orientalis)
5 The Dwarf Eagle (Aquila pennata)
6 The Wedge-tailed Eagle (Aquila audax)
7 The Striped Eagle(Aquila fasciata)
8 The Crested Eagle (Spizaetus occipitalis)
9 The War Eagle (Spizaetus bellicosus).
10 The Harpy Eagle (Harpyia destructor)
11 The Screech Eagle (Haliaetus vocifer)
12 The White-tailed Eagle (Haliaetus albicilla)
13 The Baldheaded Eagle (Haliaetus leucocephalus)
14 The Osprey (Pandion Haliaetus)

talis, a small bird with a crest four inches long. In Central and South America are crested members of the group, *S.* (*Lophotriorchis*) *isidori* and *S. ornatus*.

EAGLE OWL, an owl of the genus *Bubo* (family *Strigidæ*, horned owls, order *Accipitres*), represented in nearly all parts of the world except Australia. Of rare occurrence in Great Britain, it is common in the foot-hills of the Ural Mountains, and throughout Siberia as far as China. In the northern Old World *B. ignavus* is one of the largest owls, of unsurpassed strength and daring. The colors are black, brown and white, mottled. A grown specimen weighs about eight pounds and measures 26 inches from bill to end of tail; the wing is 18 inches long, and the plume feathers, constituting the horns, are nearly four inches in length. It is the boldest and most ravenous owl, and is a match for the eagle. To the superstitious people of the north, its weird call-note sounded at night in the depths of the forest announces the presence of evil spirits. The great horned-owl of America (*B. virginianus*) bears a general likeness to its European congener, though smaller in length of body and wing. The colors are the same but differently arranged. The lower parts are barred rather than spotted, the breast and throat are marked with a large white patch, and a black ring is stamped on the disc of the face. Like the European species, it preys upon hares, large ground birds, rats, mice, reptiles and fish, and besides on the young of the American turkey.

EAGLE PASS, Tex., town, county-seat of Maverick County; on the Rio Grande River, the Mexican International and the Southern Pacific railroads; about 15 miles southwest of San Antonio. The principal occupations are coal-mining, agriculture by irrigation, stock-raising, and the manufacture of lumber and bricks. There is active trade in hides, wool and cattle. Eagle Pass is the port of entry for the Saluria district, and as such engaged in extensive trade with foreign ports during the Civil War. The chief structure is the Federal building. The government is under the commission plan. Pop. 3,536.

EAGLE RAY, a fish of the order *Raiæ*, of which the torpedo and the string-ray are familiar members, and associated with the sea-devil in the family *Myliobatidæ*. It is a flat fish with a very broad disc distinguished by pectoral fins which continue to the snout and then reappear at the extreme end of the head. The tail is long and slender like a whiplash. The teeth are flat for crushing crabs and for grinding shells. Though much smaller than the sea-devil, which is sometimes immense, the eagle ray often attains a considerable size. It brings forth its young alive and inhabits tropical or subtropical waters.

EAGRE, a Norse word signifying a formidable influx and surging of the tide, the same as *bore* in a river, as in the Severn and Houghly rivers and the Bay of Fundy. See BORE.

EAKINS, ēk'ĭnz, **Thomas**, American artist: b. Philadelphia, 25 July 1844. He was a pupil of Gérome. He has been professor in several art schools, lecturing there on anatomy and painting. Among his works are many pictures of American domestic scenes, out-of-door sports, portraits and several large canvases, such as Dr. Gross and Dr. Agnew at their clinics. His best work is conceded to be the 'Clinic of Professor Gross' (now at Jefferson Medical College), painted with careful attention to detail and good imagination. Other noteworthy works are 'Chess Players' (Metropolitan Museum, New York); 'The Crucifixion' (Overbrook Seminary); 'The 'Cello Player' (Pennsylvania Academy of Fine Arts); 'The Mother'; 'A Bohemian' (1913). He did some minor pieces for sculptor models, and also designed the horses of the Brooklyn Soldiers and Sailors Monument and the relief designs on the Battle Monument at Trenton.

EALING, ēl'ĭng, England, town, and also a parliamentary division of Middlesex, the former a few miles west of London. The town has a free library, science and art schools and a training college for teachers of the deaf. Pop. of town 33,031; of the parliamentary division about 72,000.

EAMES, ēmz, **Charles**, American lawyer and journalist: b. New Braintree, Mass., 20 March 1812; d. Washington, D. C., 16 March 1867. He was graduated at Harvard in 1831, and began the study of law. After accepting a position in the Navy Department at Washington in 1845, he took editorial charge of the Washington *Union*. He was sent by President Polk as United States Commissioner to the Sandwich Islands and afterward became United States Minister to Venezuela, under President Pierce. Returning in 1858 he gained a great reputation as a lawyer in admiralty cases.

EAMES, Emma, American operatic prima donna: b. Shanghai, China, 13 Aug. 1867. She studied music in Boston and Paris, singing in churches and concerts in the former city and making her début in grand opera, Paris, 13 March 1889, in 'Juliette,' appearing in grand opera at the Covent Garden, London, 1891, and in New York the same year, since which time she has been a popular member of grand opera companies in Europe and America. She married the well-known artist, Julian Story, 1891, but was divorced in 1907. In 1911 she married Emilio de Gogorza of Paris. She created the rôle of Colombe in Saint-Saëns' 'Ascanio' and the title part in 'Zaïre' by De la Nux. Her repertoire includes rôles in French, Italian, Spanish, German and English.

EAMES, Wilberforce, American bibliographer: b. Newark, N. J., 12 Oct. 1855. He has long been prominent in bibliographical matters, having been assistant at the Lenox Library, New York, 1885; assistant librarian 1892; librarian 1893–95, when upon the consolidation of the Astor Library and Tilden Trust as the New York Public Library, Astor, Lenox and Tilden Foundations, he became librarian of the Lenox branch. He edited volumes 15–20 of 'Sabin's Dictionary of Books relating to America' (1885–92). Among his works are 'Bibliographies of the Bay Psalm Book' (1885); of 'Ptolemy's Geography' (1886), and of 'Sir Walter Raleigh'; bibliographic notes on 'Eliot's Indian Bible' (1890), reprinted from 'Pilling's Indian Biographies,' and a bibliographic account of the early catechisms of New England (1898). He edited 'John Eliot's Logick Primer 1672' (1904); 'Humble Request of Governor Winthrop and the Company, 1630'

(1905). He contributed a list of catalogues, etc., published for the English book trade from 1595–1902 to Growoll's 'Three Centuries of English Booktrade Bibliography' (1903). He compiled for the New York Public Library a list of maps of the world (1904).

EAMES, William S., American architect: b. Clinton, Mich., 4 Aug. 1857; d. 5 March 1915. He received his education at Washington University and at the Ecole des Beaux-Arts, Paris, and at Rome. He settled at Saint Louis, Mo., and there practised his profession after 1862, where he also served as deputy commissioner of public buildings in 1881–83. In 1904 he represented the United States at the International Congress held at Madrid, Spain. In 1904–05 he was president of the American Institute of Architects.

EAR, Anatomy, Physiology and Disorders of the. In most of the animal creation the vibrations which we term sound have special portions of the body for their recognition, more or less precise; although in the lower forms every part of the simple organism may respond to them in some degree. The earliest separation of a distinct organ of equilibrium rather than of hearing is seen in the Medusæ, of which the common nettle of the salt waters is a well-known example. Here we find certain of the tentacles provided with delicate cells having hair-like projections and enclosing a chalky concretion, the otolith (Fig. 1). This structure of a tiny vesicle with single or multiple otolithic contents (Fig. 2), connected with the more sensitive or distinctly nervous portions of the organism may be regarded as the fundamental form of the ear; but it must be questioned whether the otolith apparatus has a really auditory function or is wholly concerned with the equilibrium or static sense, the stony

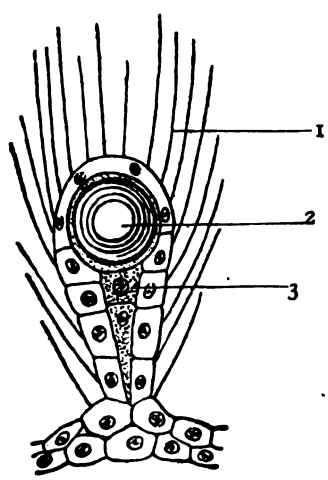

FIG. 1.— 1. Hairs of the hair-cells; 2. Otolith; 3. Sensient (nerve) cells.

concretions serving like plummets to indicate the direction of gravitation. As it develops, it takes on more and more complicated forms of fluid-containing sacs deserving the name of "labyrinth," in which chalky particles (often of special crystalline form) lie in close relation to "hair-cells," — as we term these structures with their delicate prolongations. A nerve, more or less defined, passes to the sac (Fig. 3) and connects it with the sensory centres, which in the vertebrates and some of the higher invertebrates may be called brain-centres. This apparatus is in the vertebrates embedded in the cartilage or bone on either side of the head; and in those creatures which do not live in the water, accessory apparatus is present to help

FIG. 2.— 1. Otolith; 2. Hair-cells directed toward cavity; 3. Nerve-cells.

transmit the air-vibrations to the fluid ("endolymph") of the labyrinth. As we pass up the scale of animal life the organ of equilibrium is found more distinct from that of hearing; and thus in the lowest fishes we find that the sac assumes a ring-form (Fig. 4) by reason of the formation of a semi-circular canal with a pear-shaped widening or ampulla at either end. In these the nerve terminates in hair-cells without otoliths; while between these a large portion of the sac receives the main nerve-supply at a prominent "macula" supplied with hair-cells and otoliths. A second and a third semi-circular canal, each with its own ampulla and nerve, is found in the higher forms, and the main sac divides into two increasingly separate portions with separate nerve-supply. One of these portions communicates with the semi-circular canals while the other is connected with a tubular outgrowth, which in the highest forms coils into a spiral and is encased in a snail-shell covering, which gives it the name of "cochlea." The nerve passing to this becomes highly developed and the end-organ is greatly elaborated into an apparatus generally called after its discoverer, "Corti's organ;" (Fig. 7). Around this essential apparatus more and more complex protective envelopes and spaces filled with "perilymph" have been developed; while accessory apparatus, called middle and external ear, have been formed to aid in the conduction of sound-waves to the percipient contents of the labyrinth.

The development thus roughly traced in the ascending scale of animals can be still more perfectly seen in the development from the ovum of the embryo of the higher forms. Here we see a portion of the external surface dip inward as a pit, become separated as a closed sac beneath the surface, undergo the elaboration described, secure nerve-connection with the brain and at such points of communication develop its hair-cells and otoliths. Originally a spherical sac, its complexity soon merits its name of labyrinth and this membranous labyrinth gives form to a surrounding labyrinth of cartilage or bone, which has been longer known and studied (12, Fig. 9).

Taking the human ear as representing that of all the higher vertebrates and as an elaboration of that of lower animals, we find an acoustic nerve emerging from each side of the

pons or lower back of the brain, to pass, in close association with the nerve giving motion to the face, into the stony-hard innermost part of the temporal bone which encloses the ear. The facial nerve passes on through and practically has but accidental relation to the ear, but may be paralyzed by involvement in tympanic disease. The acoustic nerve, containing nerves for the equilibrium-organ, divides and is dis-

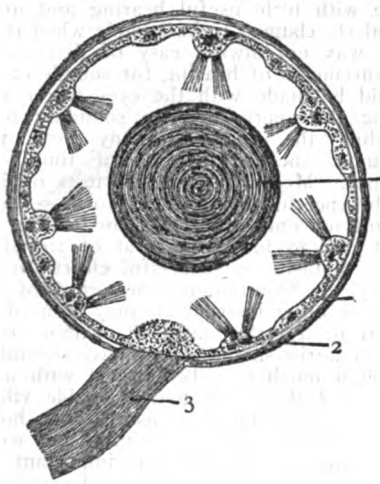

FIG. 3.— 1. Otolith; 2. Hair-cells; 3. Nerve-trunk.

tributed to the various parts of the labyrinth. At each point of its distribution cells with hair-like projections form end-organs through which impressions are received to be conveyed to the brain. Three of these points are in the three pear-shaped swellings of the semi-circular canals, each of which is at right angles to the others, so that motion of the head in whatever direction can act upon the fluid in one or more of these canals and thus be analyzed and reported to the equilibrium center in the brain. Two are in the two vestibular sacs, and the most elaborate is where the real acoustic nerve enters the base of the snail-shell (Fig. 8), and is distributed to the highly elaborated organ of Corti, here located. This consists of a fairly orderly arrangement of hair-cells without otoliths, supported by curiously modified cells of like origin (Fig. 7), all resting upon a delicate "basilar membrane" narrowest below and broadest above, which winds spirally from the bottom to the top of the shell-like cochlea, and is formed of parallel transversely stretched fibres. Here we have an apparatus comparable to the strings of a harp or piano; and just as each string of a musical instrument can vibrate in accord with those attuned to it in another and can even repeat the tones of an inaudibly distant instrument with which it is connected by a wire; so there is much to support Helmholtz's claim that each fibre of the basilar membrane is a cord tuned to a certain pitch and vibrating responsive to any tone of that exact pitch which reaches it. This serves to excite a special hair-cell resting upon it and send a nerve-impulse along the ultimate nerve-fibril of which this forms the terminus. Certainly the apparatus in form and elaboration meets most of the requirements of such a theory and its partial destruction by disease has caused loss of hearing for certain tones — low tones if the apex, high if the base, be injured.

Outside of the labyrinth or *percipient* apparatus we find a *conducting* apparatus of external and middle ear (Fig. 9). The outer ear is formed by the in-growth of a pit of the skin-surface to constitute an external auditory canal, around the edge of which gristly projections raise the skin-covering into the prominent but unimportant feature to which the name "ear" is commonly applied. The inward growth of the canal brings its bottom into close relation with the middle ear, so that only a thin partition, "the drumhead," intervenes. The middle-ear is an outward development of the mouth-cavity, which hollows out the tissues between the external and internal ears — forming the Eustachian tube as its inner portion, the drum-cavity or tympanum just within the drumhead at the bottom of the external canal, and other air-spaces, "mastoid cells," of less constant presence and form and of doubtful value, but notable because of serious disease-conditions to which they are subject. Two "windows" make communication between the middle and internal ear, both closed by membranes shutting in the fluids of the labyrinth — that closing the lower "round window" being called the secondary tympanic-membrane. The upper or "oval window" is occupied by the foot-plate of the stirrup-bone, which with the little hammer and anvil forms (Fig. 11) a compound lever between the drumhead and the labyrinth-fluids. This serves to increase the force while lessening the amplitude of the vibrations of the drumhead and thus aids the transmission of waves of sound, especially of low tones, from the air to the internal fluids. The higher animals move the external ears as an aid in locating sounds, but the muscles effecting this are rudimentary in man and the external ear can be lost with little recognizable impairment of hearing. More important, although of ill-determined working, are the muscles moving the little bones of the drum-cavity; one, the drumhead tensor, drawing in the hammer-handle and thus tightening the drum-membrane to which it is attached, and

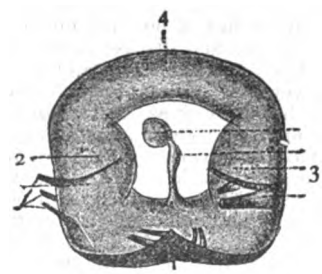

FIG. 4.— 1. Acoustic nerve and macula in vestibular sac which communicates with (2) the anterior and (3) posterior ampulla of (4) the semicircular canal.

one acting on the stirrup. Even the drumhead and chain of little ear-bones can be actually or virtually destroyed with preservation of a large part of the hearing; but their presence in damaged condition may be a serious obstacle to useful function by impeding sound-conduction.

The upper and lower limits of human hearing are somewhat in dispute, but it is fairly safe to say that tones of 32 double vibrations per

second and up through 10 octaves, should be audible to a healthy ear. If a cog-wheel touching a card or other elastic plate be turned with increasing speed the individual strokes or vibrations can be distinguished up to 16 per second;

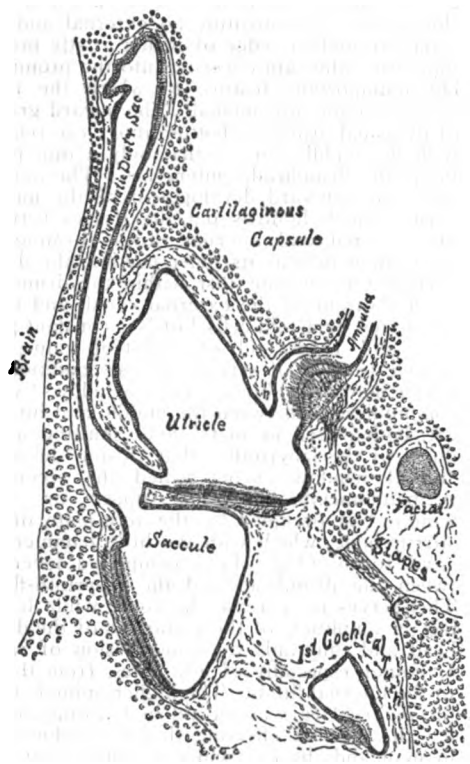

FIG. 5.— Developing labyrinth dividing into two sacs with separate areas of hair-cells.

then they blend and a continuous tone is produced; but the tone heard may be an overtone and not that of 16 per second as is often claimed. Through the thin young drumhead or one having an opening in it, still higher tones can be heard, possibly up to 55,000 vibrations; but age and disease easily effect changes which bar out these high and relatively weak tones: yet it is striking to note how well they may be heard by those deaf to ordinary speech. Those unable to enter general conversation by reason of impairment of the conducting apparatus may often hear the same voice readily over the telephone, which transposes it to a higher key; and some much-advertised hearing-helps have their value as portable telephone lines: Human speech, the hearing of which is in civilized life the most important use of the ear, has a range from near the lowest limit of perception in the sound of R to some 4,000 vibrations per second in the sibilants S and X. We have in speech, therefore, with its easy gradations of intensity from faint whispers to loud shouts, a ready means of testing the hearing and measuring its defects. Variable as are voices or even the same voice within its range, it constitutes our best practical test of the degree of deafness. Generally the faintest articulate whisper should be heard at arm's length and a loud "stage whisper" 50 feet or more. The numbers up to 100 make good tests if rightly selected and should be spoken clearly with the "reserve-air" which can be expelled from the lungs after an ordinary "tidal expiration"; and they should be repeated by the person examined in evidence that they have been correctly heard. The watch is a very variable, limited and imperfect test, which may be ill-heard by ears otherwise perfect, well-heard by some with little useful hearing and imagined or falsely claimed to be audible when it is not, in a way not always easy of detection. All measurements of hearing for sounds or speech should be made with the eyes screened from seeing the approach of a sounding body or "reading the lips" as many deaf persons do most successfully, yet at times unconsciously. Medically, the best tests of hearing are by speech and by tuning-forks — the latter serving not only to measure the hearing or loss of it, but to locate the seat of trouble as a prime requisite to successful effort for its recovery. A "continuous tone-series" of tuning-forks or other instruments may be used by the expert to test the entire 10 or more octaves; and the aurist should always have several forks, although much may be learned with a single one. A fork of 200 to 500 double vibrations per second is the most useful and should be seven or more inches in length and weigh as many ounces: the latter is important as the loudness and duration of tone depend upon it. One of 30 to 50 and one of 2,000 double vibrations should also be used, while intermediate tones have value. The lower forks should have thickened ends or clamps or pieces of rubber-tubing on the tips to damp the "over-tones," which may be heard by ears to which the fundamental note is inaudible. The fork should be struck by falling of its own weight through its own height upon a rather dead surface such as the top of the knee, and will thus give a tone of fairly constant strength; and testing a number of normal ears will show for each fork at what distance or for how many seconds it

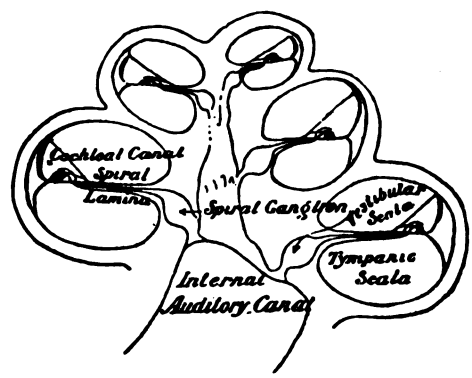

FIG. 6.— Diagram of the cochlea in section with the channels for its nerves and the perilymph spaces which surround the cochleal canal in its windings.

should be heard after a standard blow. Thus if a fork which a normal ear hears at 15 inches or for 100 seconds is heard by a deaf ear only 5 inches or for 30 seconds, 5:15 or 30:100 fairly represents the fraction of hearing remaining.*

*NOTE.—Strictly, the hearing is as the *squares* of such numbers.

Ears with impairment of the percipient apparatus of the internal-ear hear high sounds relatively less as a rule; those with the more usual conduction-defect hear low tones worse. A case of "nerve-deafness" may hear no sound from the 2,000 fork — a case of tympanic catarrh none from the 50 fork; although all other tones are fairly or even perfectly heard.

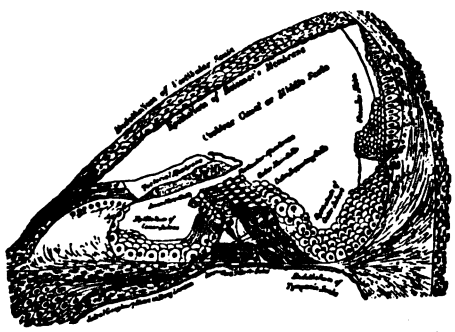

FIG. 7.— Scheme of human cochleal canal in section showing Corti's organ and its nerve connections.

A whistle devised by Galton giving tones from 4,000 up to 32,000 double vibrations is a practical and useful aid in studying the upper limits of hearing, as are the steel rods suspended by threads introduced by Koenig, since tuning-forks of such a pitch are unusual and costly. All of these tests should be made at the side of the head, but not so near that they may be *felt* instead of heard. The other ear may need to be closed with a down cushion or other adequate cover and we must avoid several "deaf-spots" nearly opposite the opening of the canal where the sound-waves by interference are weakened or lost.

Thus far we have considered tests of the hearing for sounds coming through the air in the usual way; but if the handle of a vibrating tuning-fork or other sounding instrument be rested upon the head it will be heard through the bone, and the sound will generally be much louder if the fingers are stuck into the ears. If only one ear be stopped, it will be heard louder in this ear — so much so that the other generally fails to recognize its vibration, even though the fork is resting close behind or above it. Normally this "bone-conduction" is only half as loud as "air-conduction" — the fork which should be heard for 100 seconds through the air in front of the ear is heard but 45 when resting behind it. It can usually be heard from the bridge of the nose or the teeth after it has become inaudible back of the ear; but when unheard here it should be audible for a further period if held close outside of the canal-opening. Yet disease-conditions can affect the matter like stuffing the fingers in the ears; the obstructions in the conducting apparatus which bar out in greater or less degree the outside air-vibrations shut in and echo back upon the percipient apparatus sounds produced or conducted within the head. The deafer ear may hear the sound by bone-conduction better than its fellow. More than this — it can often hear better than a normal ear, perceiving through the bone for 55 seconds, perhaps, the vibrations which ought to be heard for only 45. With this generally goes a marked loss of hearing through the air, which may be reduced from 100 seconds to 40, 20 or less. Under such conditions bone-conduction will be better than air-conduction and the sound will be louder as well as longer when resting on the head. This constitutes Rinne's or Schwabach's test and is simplified by resting the handle of the lightly vibrating fork back of the ear and then placing it outside the opening with the question "louder back or front, front or back?" The perception through the bone, especially at the bridge of the nose, ought to be nearly the same in duration as the *feeling* of the vibrations by the examiner's fingers; and Gardiner Brown saved time and confusion by noting how many seconds before or after his fingers lost the vibration, it ceased to be heard in the ear. Bone-conduction may greatly preponderate, in evidence of the conductive defect in an ear with marked loss of air-conduction, and yet this test or Schwabach's timing will show that the perceptive apparatus is also defective and loses the sound sooner than normal, instead of having it exaggerated. So we must test the actual, as well as the relative, perception through the bone.

Another delicate and important test may be here mentioned. The drum-cavity communicates with the throat back of the nose by a trumpet-shaped tube called after its describer Eustachius. This serves as a drain for the removal of any mucus from the drum-cavity and as a ventilating passage for maintaining equal air-pressure on each side of the drum-head. It is really a slit habitually closed, but opens in the act of swallowing or yawning, from the action of the muscles lifting the palate. If a sounding tuning-fork, then, is held before the nostrils as the patient swallows there should be a brief opening of these tubes permitting freer passage of the sound to the ear. We thus determine the normal action or its

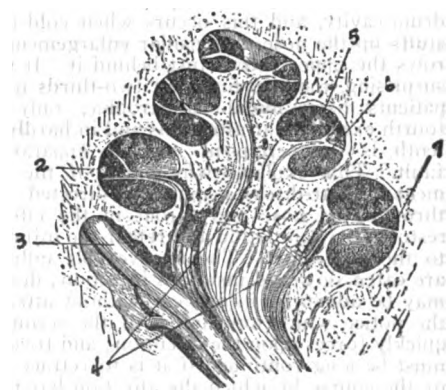

FIG. 8.— Cut through the cochlea, showing its nerve (4) passing to the turns (2.7) of the cochleal canal, above which are those of the vestibular scala (5) and below the tympanic (6); the facial nerve (3) is seen in close relation to the auditory.

lack in these very essential parts of the apparatus.

This proper ventilation of the drum-cavity is needful for perfect function. It is said that the head of the military drum will split if there is no opening in the side; and certainly a stuffed Eustachian tube makes all concussions painful if not damaging to the drum-membrane. Any

excess of pressure within interferes with the freedom of the windows, while any lack of air makes pressure on the outside preponderant, forcing in the drumhead and through the chain of bones pressing upon the labyrinth. More than this, if the partial vacuum in the drum-cavity is increased through absorption of the unrenewed air by the moist lining, the drumhead becomes stretched until it collapses into contact with the inner wall, or the walls congest and swell to fill the space or else fluid is poured out to occupy the cavity. Generally all of these

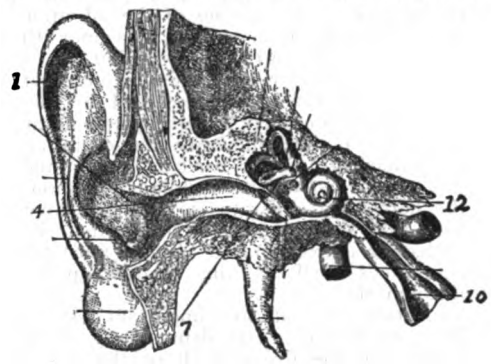

FIG. 9.— Section through external ear with its pinna (1) and (4) canal and the middle ear with its drumhead (7) and Eustachian tube (10), showing the labyrinth with its cochlea (12) and semicircular canals.

results are present in varying degree and from this comes the large majority of ear-diseases. So, too, interference with the freedom of the breathing through the nose unfavorably affects the ears. If one holds the nose and blows, air will be forced up the tubes into the drum-cavities, and swallowing motions have to be made to relieve the distention. If this swallowing is done while the nose is held closed, strong suction is exercised, making partial vacuum in the drum-cavity, and this occurs when cold-taking stuffs up the nose or tonsillar enlargement narrows the upper throat just behind it. It is not surprising, then, to find that two-thirds of ear-patients have middle-ear trouble, only one-fourth external-ear affections and in hardly one-tenth is the percipient nervous apparatus at fault. This explains why much of the treatment of ear-diseases must be directed to or through the nose and throat in the effort to restore free ventilation and repair the injury due to the lack of it. The unfavorable influences are often slow and insidious in action; deafness may be advanced in one ear without attracting the notice which any defect of the second ear quickly forces upon the attention; and treatment must be long continued if it is to retrace much of the course by which the affection has passed to its later stages. Discouragements are frequent, and the conscientious aurist has to tell his patient that only the recent losses can probably be recovered, and that ill-health or recurrent cold-takings may offset his best efforts. Yet many of these cases tend to grow steadily worse unless judiciously treated and a gain, however slight, is better than a loss. Mere inflation of air up the Eustachian tube by the Politzer bag or the catheter can aid the earlier stages; but in chronic conditions intratympanic medication must be used to stimulate the lining of the drum-cavity and retrace the steps by which it has become thickened and stiffened.

Accompanying the defect of hearing for outside sounds there may be greatly increased hearing of noises within the head. Every one hears a singing in the ear when a shell or other resonator is held against it; and similar results often follow any thickening and stiffening of the conducting apparatus. Tinnitus, as the subjective sound is called, may be due to many causes, however, and its relief is often difficult. Generally a perception of the sounds of the blood-circulation, it may be caused by changes in the blood itself in anæmia, by overaction of the heart, by brain-pressure due occasionally to stuffiness of the upper nasal passages, as well as to more local affections. It is usually worse when lying down and in a silent place, since outside noises and occupation of mind and body make it less noticeable; but it is in some cases unceasing and intrusive, seeming to bar out other hearing, and may be almost maddening. In its milder forms it is annoying and excites apprehension of deafness or of brain-disease, with which it is known to be sometimes associated; but its many causes, often wholly trivial, must be remembered and rational measures employed for its relief. As stuffing of the Eustachian tubes or tension of the drumhead and chain of bones are its common causes, much relief can often be gained by simple hot gargling to free the former, or gentle massage of the drum-structures, as may be well done with the hands.

A curious characteristic of conduction-defects is the ability to *hear better in a noise*, often better than normal ears. A person deaf to ordinary speech in a quiet place will hear on a train much that is inaudible to persons nearer the speaker. One with nerve-deafness will be unduly disturbed by other noises, although perhaps unconscious of defects in a still place.

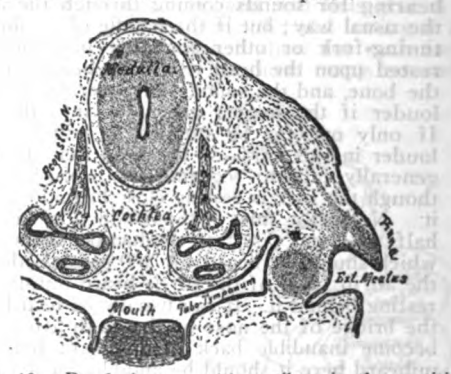

FIG. 10.— Developing ear with cartilage in the partition between external and middle ear, which are beginning to form.

Only less important than freedom of the Eustachian tube is a healthy free condition of the external canal. This is lined with skin and supplied with glands like the sweat-glands elsewhere, but furnishing the ear-wax or cerumen, which consists of the dead skin-scales and oily material. The purpose of this seems to be to arrest by its stickiness the entrance of dust, small insects, etc., from outside; but it serves a more useful purpose in cleansing the ear. The growth of new skin is most active at the centre

of the drumhead and is there rapid enough to spread out over the membrane, moving the older cells before it by a glacier-progress which carries them beyond the margin and out upon the walls of the canal before they become effete enough to be thrown off. Hence the normal drumhead is self-cleansing and needs no officious aid. The loosening scales of dead skin pass out along the walls of the canal and about its middle become a pasty mixture with the secretion of the cerumen-glands. This clings to the fine hairs of the canal, but is gradually worked outward by the motions of the jaw-joint, which presses upon the canal, and drying into unnoticed scales, it escapes from the exit. Under diseased conditions, including those of the throat and middle-ear, the wax tends to diminish in quantity and grow harder, escaping less readily or collecting in firm plugs. So long as any crack remains for the sound-waves to pass between it and the wall, hearing may be unaffected by an almost total filling of the canal; but jarring may force it down upon the drumhead and moisture may swell it into complete closure. Marked and sudden deafness results, often with dizziness, tinnitus or coughing. The plug may dry or crack away from the wall, quickly relieving the trouble, but only for the time; and it becomes so molded to the irregular curves of the canal as to make it difficult to remove. Most of the sponges and spoons offered in the drug-stores are good only for ramming in the wax more firmly and pressing it down upon the drumhead. They should never be used. The best solvent for ear-wax is hot water, and it should be syringed in with gentle force until the last particle of the plug has been removed. Dropping in of oil or other fluids rarely does much to loosen the collection — they can often increase the distress caused by its presence — they certainly cannot remove it, although some hope that they will do so seems present to many that use them. Any violence in digging out the plug or too vigorously working even with the syringe is to be condemned. Underneath it skin-flakes have been forming which are often partly incorporated in its mass, partly still fast to the walls — ready like "hang-nails" to tear down into the quick and leave open wounds, very easy of infection. One-seventh of the cases of the aural surgeon require removal of this ear-wax, rather especially of those of his private patients who *seek to be too clean*. It is easy to do it skilfully and promptly, yet it is often not so removed. If spoon-like instruments be used at all they should be *sharp* — they will thus be more efficient, while a mistaken idea of harmlessness will make dull instruments doubly dangerous. It is true of many a thing besides a firearm that a man "did not know it was loaded."

Seeds, beads and other foreign bodies are sometimes put into the ears. If they are let alone they may remain for many years without doing the least harm; but forcible removal has often done great or fatal injury. If the ear is directed downward they will often fall out, especially with a little rotary rubbing in front of the ear. The syringe will almost invariably bring them away promptly and safely. If they have been rammed in and fixed, it is really gentler to remove them by laying forward the soft parts under ether and operating in the bony canal, even chiseling it wider at need.

Two other affections of the external ear make up much of the 25 per cent of diseases involving this part — the diffused and the circumscribed inflammations of the canal. The first may be broadly called eczema — the latter furuncle or boil. Gout and many general conditions can predispose to the eczematous inflammation, which by its heat and moisture makes the ear a hot-bed for the growth of the molds and bacteria which maintain or increase the trouble; and it may have an intensity verging into erysipelas. The milder, chronic forms are generally responsible for furuncles, for they furnish the itching which leads to scratching and the germs which punish this. "What did you scratch it with?" will generally bring con-

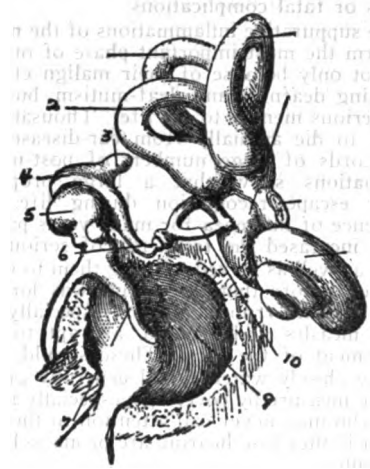

FIG. 11.— Inner surface of drumhead (9), to which is attached the handle (7) of the hammer, the head (5) of which is hinged to the anvil (4), the long arm (6) of which connects with the stirrup (10) the chain pivots on the horizontal arm (3) of the anvil and conveys vibrations to the labyrinth.

fession of a hairpin or a match-stick according to the sex; and boils are more common on the right-hand side. The suffering caused by a boil may be extreme, sometimes keeping the patient walking the floor all night. They are rarely serious matters, but each tends to cause others, so they cannot be made light of. They consist of an infective inflammation of the glands of the skin lining the canal and are apt to be trivial when the superficial sebaceous glands are involved, but more severe if a deeper cerumen-gland is the seat. These glands extend into the subcutaneous tissue, possibly into the periosteum, so their inflammation can excite a periostitis pressing the ear out of place and perhaps strongly suggesting mastoid inflammation. Pressure or motion of the parts, as in chewing, is acutely painful; but firm pressure on the bone can be comfortably borne if all motion of the canal be avoided. Hot douching (110° F.) is usually comforting and if fully used has an excellent tonic effect; *warmth* and moisture often increase and renew the trouble. The infection should be fought by mercurial oxide ointment and, if bearable, a firm plug covered with it should be passed into the swollen canal where it will exercise pressure, secure a useful massage from each jaw-motion and continue throughout the day and night the rubbing in of the salve.

Bony outgrowths of the walls sometimes narrow or close the external canal and less often cancerous growths involve it and the external ear. The bony growths are curiously common in the ears of ancient Peruvian and Mound-builders' skulls and in modern times in Hawaii and in England. The London surgeons among their private patients see and remove more of these bony outgrowths than are reported from all the hospitals of the world. Their causes are not clear, and bathing has been suggested as influencing their formation. As seen in other than Englishmen, the great majority seem due to long-continued discharge from the ear; and this suppuration must be cured or the growth removed, lest the confinement of pus may lead to serious or fatal complications.

The suppurative inflammations of the middle-ear form the most important phase of our subject, not only because of their malign effect in producing deafness and deaf-mutism, but from their serious menace to the life. Thousands are known to die annually from ear-diseases, and the records of large numbers of post-mortem examinations show that a large proportion usually escape recognition during life. The prevalence of influenza for many years past has hugely increased the frequency of serious outcomes, as well as served to bring them to notice; but even before that the record was long and grim. All the eruptive fevers, especially scarlatina, measles and typhoid, are apt to bring involvement of the ears. These should, therefore, be closely watched and generally guarded in some measure by coverings, especially in children, who may never call attention to their ears and yet if they lose hearing are prone to become deaf-mutes.

It is well known that discharge from the ear is apt to lessen or cease at the onset of serious extension and that bottling up of the flow may give rise to such results; but the somewhat prevalent view that such suppuration should be "let alone and it will be outgrown" is as mistaken as is the idea that it is dangerous to bring it to an end. To "stop it up" is wholly different from stopping it by cure; and the chronic cases of slight discharge, often hardly noticeable, are those from which fatal diseases such as brain-abscess, pyæmia and sinus-clotting are generally recruited. Few good insurance companies will have anything to do with a man having a long-standing running ear — the risk for the individual may not be very frightful, but it is enough in any large aggregate to consume all the profit of insuring lives.

Suppuration of the middle-ear is ushered in by pain, and the severity of this "ear-ache" is at times some measure of the seriousness of the attack. The onset may be insidious or misleading, however, and relief may be sought of the dentist; while in children the fever, delirium or convulsions may draw attention away from the ears. Stains on the pillow or visible moisture in the canal may be the first indications that the ears are involved. But every such case, however stormy or mild its beginning, may go on immediately or remotely to the worst of issues; and it is our duty to take reasonable precautions from the start, lest we have reason later to reproach ourselves. Mere *external protection* as by ear-tabs or a night-cap may conserve the recuperative powers; gentle hot douching with clean water may relieve the pain by reducing the inflammatory congestion; and spray and gargling may strike at the root of the trouble in nose and throat. However ill the patient may be in other respects, it is mistaken kindness to withhold these simple yet often effective measures of treatment. The tendency is to a "gathering in the ear," which may be watery or mucous or may be purulent and infective. If the simple measures named, with dry heat from a salt-bag or hot water-bottle fail, there is need for surgical aid. Drainage by the natural Eustachian channel can only sometimes be gained; but after good cleansing of the nose and upper throat, it should be gently attempted by the Politzer method or the catheter. Abuse of these means is rightly condemned; so only the expert can maintain his right to use them if ill results follow — in spite rather than because of them. If they fail and the drumhead is seen to be bulging, especially with yellowish fluid, it should be delicately cut along its back margin to furnish a free escape for the collected fluid. If the swelling is marked at its upper portion, the knife should be carried up into this region, coming out in a sweep to the bone along the upper back wall. Free bleeding may be encouraged by warm douching and is more effective from such a cut than from external leeching; yet since much of the blood-exit from the drum-cavity is along the front wall of the canal, leeching in front of the ear may be almost as good, but should remove not less than four to eight ounces. A wick of gauze or absorbent cotton, dry or moistened with carbolic or boric glycerine, should be inserted deep into the canal and the protective covering replaced. "But if you cut the drumhead you destroy the hearing!" is a fallacy which is still repeated. The opening of the drumhead is a delicate operation, often very painful so as to require ether or other anæsthesia and capable of doing injury to the structures beyond it; but it only forestalls the opening which would occur spontaneously, makes a free and well-placed opening and really saves a drumhead from ulcerating through. Far more important is its influence for good in relieving the injurious pressure in the drum-cavity and it may be really life-saving in preventing fatal extension of the suppuration.

It is impossible to foresee how mild or serious any case is going to prove; and without panicky fighting of shadows, it is only reasonable to press home all due precautions. The patient is best in bed, especially if feverish, and all exposure and stimulating diet should be avoided. Constipation must be relieved, for straining of every sort is not only painful but increases the congestion.

With the opening, artificial or spontaneous, of the drum-membrane, there is generally relief of the pain; yet this is almost sure to recur, especially at night, but with lessening severity, duration and frequency. The fever, which is commonly marked in children, declines and some of the lost sleep is made up. The tension within the drum-cavity is lessened by the escape of the "gathering" and obtains continued relief by the persistence of the discharge. This is thin and bloody at first, then thicker and probably stringy. Its amount is often surprising, so that hourly cleansing is needful, and it may excoriate the skin in and about the canal, call-

ing for protective ointments. The ideal treatment is thoroughly to cleanse before cutting the drumhead and thereafter as frequently as the flow demands to change the sterile wicks of cotton in the canal. If these are prepared by the hundred, each wrapped in a waxed paper and the package of them baked, the patient can readily remove the moist plug and substitute a clean one without contaminating it. Practically, frequent syringing with boiled water at 110° F. or more and a clean soft-rubber bulb, better relieves the pain and cleanses the deeper parts of the canal. The heat can penetrate where the water cannot and is the best astringent and stimulant. After two or three weeks the discharge should cease, and another week or two should bring cure; but the cardinal fact in these cases is the infected character of the inflammation, which endangers serious destruction in the drum-cavity and adjacent more vital regions. Often worse than the destruction is the scarring which results from nature's effort at repair. An opening in the drumhead generally heals and may leave no visible scar; in an important minority of cases the edges are skinned over, preventing its closure and grafting skin upon the mucous surfaces within. Nature is prepared to sweep away *fluid* waste material in the drum-cavity, but skin-flakes forming there are difficult of removal; they tend to collect and by their presence excite more exaggerated scaling. Onion-like masses may thus form, constituting «cholesteatoma» or pearly tumor, and these can do much damage by their pressure as well as maintain or renew the suppuration. The bony walls and the little ear-bones may be destroyed by pressure or decay; and while an exit may thus be made for the cholesteatoma-mass, it too often works inward instead of outward, damaging the labyrinth and may carry the infective process into the brain-case. Just under the thin floor of the drum-cavity is the head of the jugular vein, its intracranial part is equally vulnerable just behind, and an even thinner roof alone protects the brain-membranes above, It is not surprising, then, that symptoms of brain-inflammation are not unusual in ear-diseases; and while these may be merely irritative and transitory, they are at times of deadly meaning. Where the bone suppurates and decays the mastoid-projection just behind the ear is apt to be involved, forming a «mastoid abscess,» and may need to be chiseled open to give exit to the matter and dead bone. Even without this, the inner wall of bone can decay and an abscess-collection form on the outer surface of the brain-membrane. Yet this is strong and firm and may thicken to better protect all within; so such «extra-dural abscesses» have but a fraction of the danger of a collection upon or in the brain itself. Even this can now be often recognized in time by its subnormal pulse and temperature, and located sufficiently by its symptoms to permit of surgical relief; and nearly 50 per cent of the reported operations have been followed by cure. The infection can penetrate the adjacent great blood-vessels and cause clotting within them, with general blood-poisoning and formation of abscesses in the lungs or other parts of the body; but the septic clot can be recognized and safely removed in many cases even when extending down almost to the heart.

Disease of the nervous apparatus of the internal ear is met in hardly 10 per cent of ear-patients. Some of these are due to injury and fracture at the base of the skull, others to cerebrospinal meningitis or other severe fevers, more still to the extension inward of the catarrhal or the suppurative middle-ear inflammations. Mumps, too, or diphtheria may be followed by sudden total deafness. Inherited syphilis is one of the insidious and slowly acting causes, generally also giving rise to clouding of the cornea of the eye and marked by typical malformation of the second teeth. In any of these conditions the main hope of relief is through the absorption by mercury and iodine of the exuded material, which in the meningitis cases may be in the brain itself and not in the labyrinth. Of notable interest are the cases of «boiler-makers' deafness,» as we sometimes call a group of occupation-disorders, usually located in the internal ear, and affecting those subject to persistent clangor — a condition which may compel change of work, if freeing the Eustachian tubes and good plugging of the external canals fails to relieve the advance of deafness. Important too are the cases of vertigo, due to ear-disease. Menière called attention to some of these as caused by labyrinthine apoplexy and they are often called by his name; but the recognizable disease may be of different nature and often is located in the drum-cavity, indirectly affecting the organ of equilibrium in the semi-circular canals. Influenza has caused a number of these cases in which the hearing for more or less of the scale has been suddenly lost and the patient made incapable for days or weeks of lifting the head from the pillow. Absorption is here also the best hope; but in some extreme cases advantage has been taken of the damaging effect upon the ear of large doses of quinia, and the irritative condition has been by it changed to a destruction with cessation of the vertigo.

The systematic development by Barany and others of tests of the equilibrium-apparatus has given us a most valuable power to stimulate chosen portions of the labyrinth and thus to investigate not only the end-organ, but the brain-centres and the paths which convey impressions to them. Revolving the patient in a pivoted chair or using a cold or hot douche in the ear can elicit marked and definite oscillation of the eyes, technically known as «nystagmus»; and this, which may be varied at will in the normal, is modified or prevented by diseased conditions. Vertigo is usually produced by such stimulation and the perverted equilibrium-sense causes the patient to point astray, to fall in known direction or to be made «sea-sick.» Interruption of transmission along this path or that may clearly point to the exact site of disease and furnish information of far-reaching value to the brain-specialist and the surgeon for life-saving intervention.

Finally we may mention the brain-affections in which the hearing-centres, especially that for speech, are involved, when we may have «word-deafness,» which prevents recognition of the spoken word, although the hearing is perfect for tones of every pitch; for while the ear itself is uninvolved, it is only through ear-examination that one can by exclusion reach a correct diag-

nosis and perhaps point the way for the surgical removal of a brain-tumor.

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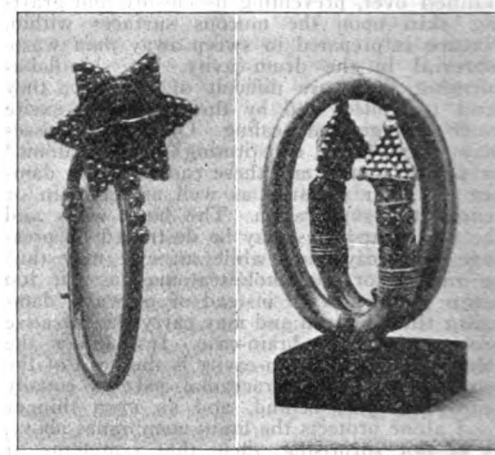
B. ALEX. RANDALL, M.A., M.D.

EAR COCKLE, a disease peculiar to wheat caused by the presence in the grain of worms belonging to the family *Vibria.* In some parts of Europe the disease is known as purples.

EAR OF DIONYSIUS, a famous quarry near Syracuse, in which the slightest whisper was audible at a great distance. It was connected by a secret passage to the palace of Dionysius, the Elder, who died 367 B.C.; also an acoustic instrument with a large mouthpiece to collect the sound, which a flexible tube conducts to the ear. The cave was afterward used as a prison.

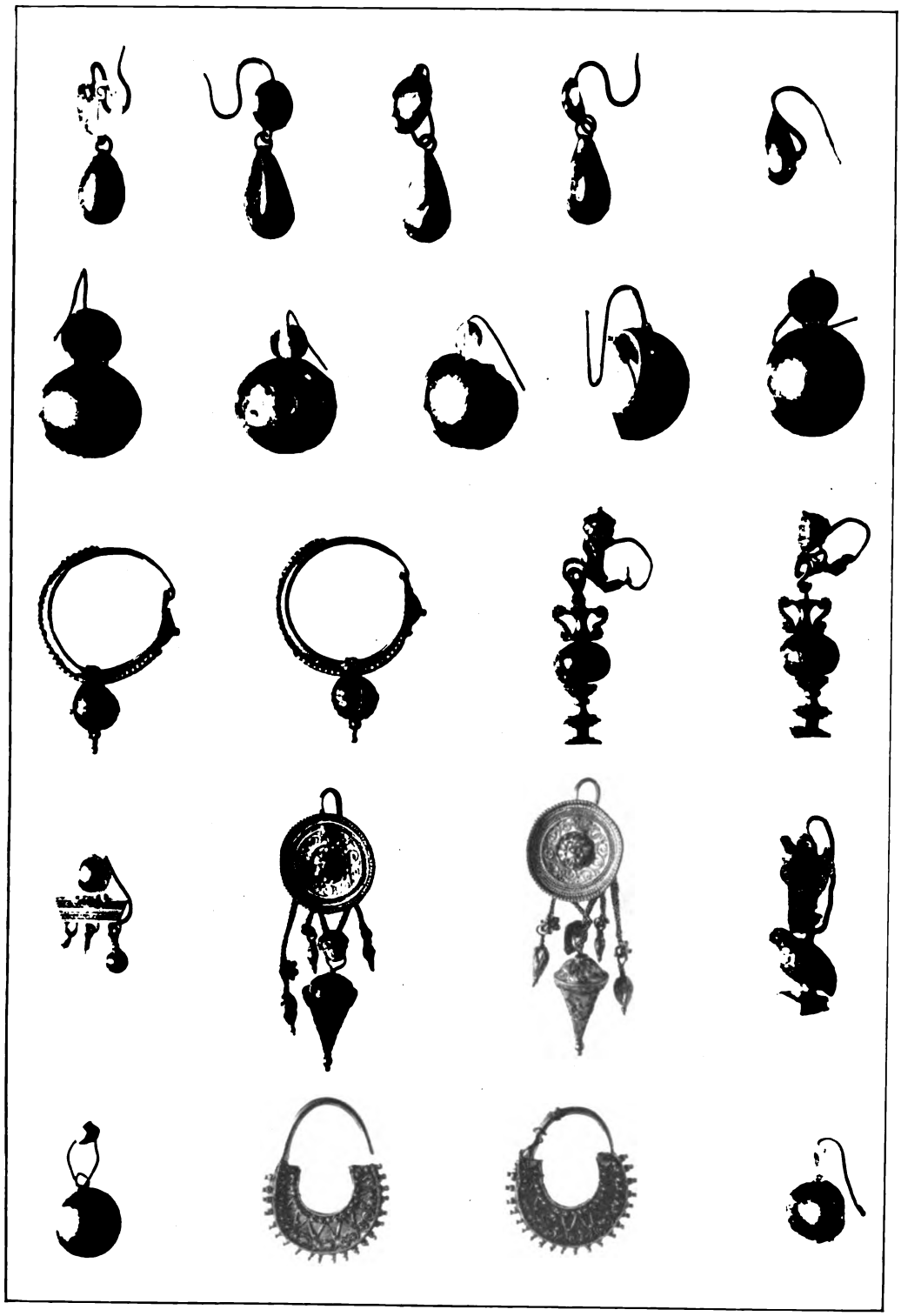
EAR-RINGS. Primarily the ear-ring is a ring for adornment of the ear. More broadly it implies any ear ornament. Usually the ring is attached to the ear by passing through its pierced lobe. A gracefully curved hook is often the attaching part where the ornament is composed of more than one piece (pendant). In modern times the ear-ring is frequently fastened to the ear by screwing firmly to a small plate at the back of the ear, thus avoiding the piercing of the lobe. Ear-rings date back to prehistoric times. In Homer's 'Iliad' we read that Juno "put in her ears, skilfully pierced, ear-rings worked and ornamented with a triple precious stone." The ancient East Indians, Medes, Persians, Egyptians, Arabians and Hebrews wore ear-rings. The Egyptians wore them of various artistic forms. The Etruscans made gold ear-rings, showing a tendency to those of the Egyptians, of delicate filigree work and minute granulation. They took the form of flowers, fruits, vases, shields, rosettes, crescents, cornucopias, tassels, peacocks, swans, cocks, Medusa heads, etc. The Greeks excelled in the art of making gold ear-rings and gave them numerous beautiful forms; the simpler form was a ring and these were termed *ellobia* or *enotia.* Their *stalagma* were pendants in the form of drops of water, as the name implies; their *crotalia* were composed of little rows of pendant forms (usually pitcher shape) and their name was derived from the fact that they *rattled* as they struck one another on the motion of the wearer. Even the statues of the goddesses (whether of stone, wood, ivory or precious metal) had golden ear-rings; the Athena of Phidias, ancient writers tell us, wore such adornment. Men did not wear ear-rings after adolescence. The Romans adopted the Greek fashion, but their ear-rings were of a heavier, more elaborate form; the Roman ladies' *inaures* were often gems of great value. Seneca (1st century A.D.) wrote scathingly of the fashion in his day: "Thy wife carries in her ears the revenue of a rich family." Elsewhere he says: "I see pearls, not one only for each ear; the ears are now strained to carry heavier



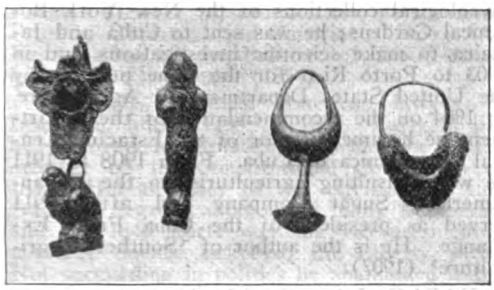
Ear-ring (Roman Imperial Period). Spiral ear-ring (4th or 5th century B. C.).

weights. The pearls are in a cluster: they are superposing one another in rows. The folly of women never before so subdued the wish of men; it is two, it is three patrimonies that they suspend from their ears." The Republican Romans despised the use of ear-rings by men, and the comic poet Plautus rails at the Carthaginian men that wore one. Later, however, the men took to this adornment so popularly that the Emperor Alexander Severus (3d century A.D.) had to forbid their use by men in an edict. The Byzantines appear to have abstained from ear-rings, in spite of the strong influence of Asia. The ancient Gauls and Germans adorned themselves with bronze ear-rings after East Roman prototypes. At the time of the migration of the nations the wearing of ear-rings had become a universal custom. The oldest ear-ring extant, probably, is of gold pierced like filigree work; it is in the Germanic Museum at Nuremberg, where are also some East Gothic ear-rings reminding one forcibly of present-day pendants. A thin wire hoop (to thrust through the ear) has a richly or-

ANCIENT EARRINGS



namented part attached, and a precious stone or pearl hangs from the centre. Superstition was attached to the ear-ring by the Northern races at least, for, as the *sagas* tell, ear-rings prevent evil sounds and malicious suggestions from entering the ear, hence their ornamentation with mysterious talismanic signs.



Ear-rings and figure of goddess, Cyprioti.

In the Middle Ages ear-rings were generally termed "rings for the ear," clearly indicating their form. Men wore them later on in one (the left) ear. Laborde quotes from 1452 thus: "Gift of Monseigneur the Dauphin for two circlets of gold, which were hanging and attached to the ears of Mitton, the fool of Monseigneur the Dauphin, 9 livres. Royal Accounts." Later, the custom of wearing the hair over the ears caused ear-rings to fall into disuse, coming again into vogue in the 15th and 16th centuries. A change took place in jewelry by the 17th century, and ear-rings, like the rest, were valued for their precious stones more than the richness of their material and the beauty of their handwork which the Renaissance afforded.

Our great-grandmothers wore extremely long ear-rings with dangling tassel or pitcher forms, but we now restrict the ear-ring to diamonds, single gems or coral, mostly. Ear-rings for men had a short vogue at the court of Henry II of France, and have since never been popular. We see only gypsies, sailors and a few Latins (Italians and Spanish) yet wearing gold circlets in their ears. And the medical authorities have renounced their former belief that piercing the ears was an aid to that organ.

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CLEMENT W. COUMBE.

EAR-SHELL, a much flattened univalve mollusk of the family *Haliotidæ,* allied to the keyhole limpets. It takes its name from its rough resemblance to the human ear, and is known as *ormer* and *oreille de mer* in the Channel Islands, where one species is extensively used in making ornaments. These mollusks in various species occur on rocky shores in all warm regions, and in California are called abalones. Their richly nacreous shells are used extensively for the making of buttons and fancy articles; and in China and Malaya the animals are eaten fresh and also preserved as food in large quantities. Consult Cooke, 'Mollusks' (New York 1895).

EAR-TRUMPET, an instrument used to strengthen the sensation of sound in the partially deaf. The first mechanical contrivance for the purpose of improving the hearing was made by Dr. Yeardsley of London in 1848. Since that time, numerous curious devices have been invented. The unpopularity of these is due to their awkwardness in size and shape for portability. Before advising the use of such mechanical aids a careful diagnosis of the ear should be made, and the condition of the middle ear should be especially ascertained. In general these aids are apt to induce only temporary improvement and result eventually in more serious complications. The object of the ear-trumpet is to collect the sound waves and throw them into the ear in parallel waves. The curve of the collector or resonator — the reflector — must be more or less parabolic so as to give the maximum amount of sound at the entrance of the tube. For hearing at short distances *Currier's conico-cylindrical tube* is considered the best. It consists of a tube three and one-half feet long, which has a bone or hard rubber tip at one end while at the other is a bell-shaped mouthpiece made of the same material. The tip and mouthpiece are connected by an elastic spiral wire tube covered with rubber and over-spun with silk or mohair. The tube is conical, and the speaker must place his lips close to the mouth of the tube. The *London hearing dome* is made of metal, of the same variety as that used in musical instruments; the *Akou concentrator* intensifies as well as concentrates sound, and is made of bell-metal; the *Hearwell churchphone* is of hardened rubber and partly collapsible. It is of great use in long distance hearing, as are also the *audiat,* of black japanned tin; the *folding fan trumpet,* a tin horn attached to a folding black fan to conceal its use; and the *Lorgnette hearing horn,* of hardened rubber. The *otophone* has been used to teach articulation to deaf-mutes, because it carries low tones extremely well. The *dentiphone* conveys sound through the medium of the teeth and is worn at tension in the mouth. The *acousticon* is a modification of the telephone principle, extremely complex, showing on its surface the battery, earpiece, transmitter and connecting cord. It is the most perfect and most expensive of ear-trumpets. The *auris* is a modification of the acousticon, simpler and less expensive. Countless other instruments have been developed. In general their use is to be discountenanced and other aids for deafness should be used, such as lip reading, and insistence on being addressed in clearly enunciated tones.

EAR-WORM. See CORN INSECT-PESTS.

EARL, a degree of the British nobility between marquess and viscount. Until 1357 it was the highest title in England. The name came into use in the reign of Canute as *jarl,* which was transposed in English to *eorl,* and was applied to the officials who presided over the counties and who supplanted the old Saxon ealdorman. The title was made hereditary by William the Conqueror, who also assigned its judicial powers to the sheriff or vicecomes, appointed by himself. After William's reign, numerous earls were created and for a time the name was used interchangeably with count, the corresponding title on the Continent. The name of the earldom was derived from the name of the shire. The title was granted by investiture at first and it was not until the reign of Edward III that earls were created in Parliament and invested without ceremony by charter or letters patent. The last method is the one still employed. There are more than 200 earls in the United Kingdom, although the sovereignty of the title over the county has in some cases disappeared. The wife of an earl is still called a countess. The eldest son is called viscount, the younger sons honorable and the daughters lady. An earl's coronet is composed of eight pearls raised upon points, with small leaves between, above the rim. (See HERALDRY). Consult Pike, 'Constitutional History of the House of Lords'; Selden, 'Titles of Honor' (London 1614).

EARL MARSHAL, the eighth great officer of state in Great Britain, who had, anciently, several courts under his jurisdiction, as the Court of Chivalry and the Court of Honor. He is the head of the College of Arms (Herald's College), grants armorial bearings and determines all claims in connection with them. The office is hereditary in the family of the Howards.

EARLE, Alice Morse, American writer: b. Worcester, Mass., 27 April 1853; d. 1911. She was married to Henry Earle in 1874. She wrote extensively upon the manners and customs of the colonial period in New England and New York and in her various books presents a mass of quaint and interesting information. Her published works are 'The Sabbath in Puritan New England' (1891); 'Customs and Fashions in Old New England' (1893); 'Life of Margaret Winthrop' (1894); 'Diary of a Boston School Girl' (1894); 'Costumes of Colonial Times' (1895); 'Colonial Dames and Goodwives' (1895); 'Old Narragansett' (1896); 'Curious Punishments of Bygone Days' (1897); 'Colonial Days in Old New York' (1897); 'Home Life in Colonial Days' (1898); 'Child Life in Colonial Days' (1899); 'Stage Coach and Tavern Days' (1900); 'Old Time Gardens; Sundials and Roses of Yesterday' (1903); 'Sun-Dials and Roses of Yesterday' (1902); 'Two Centuries of Costume in America' (2 vols., 1903).

EARLE, Franklin Sumner, American agriculturist and botanist: b. Dwight, Ill., 4 Sept. 1856. He was educated at the University of Illinois and made special studies, chiefly in botany and biology, at the Alabama Polytechnic Institute. In 1886 he was connected with the University of Illinois, doing special mycological work, the results of which were published, with the title 'The Erysiphaceæ of Illinois,' in collaboration with T. J. Burrill. In 1894-95 he investigated Mississippi fungi for the Mississippi Agricultural Experiment Station. In 1895-96 he was assistant pathologist in charge of the mycological herbarium of the United States Department of Agriculture. From 1896 to 1901 he was professor of biology at the Alabama Polytechnic Institute. In 1897 he was appointed assistant curator in charge of the mycological collections of the New York Botanical Gardens; he was sent to Cuba and Jamaica to make scientific investigations and in 1903 to Porto Rico for the same purpose by the United States Department of Agriculture. In 1904 on the recommendation of the department he became director of the Estación Central Agronómica of Cuba. From 1908 to 1911 he was consulting agriculturist to the Cuban-American Sugar Company and after 1911 served as president of the Cuba Fruit Exchange. He is the author of 'Southern Agriculture' (1907).

EARLE, John, English philologist: b. Elston, Devonshire, 29 Jan. 1824; d. 31 Jan. 1903. He took his B.A. at Oxford in 1845; was presented to the rectory of Swanswick 1857 and was professor of Anglo-Saxon in the University of Oxford 1876-1903. His chief publications are 'Gloucester Fragments' (1861); 'Two of the Saxon Chronicles Parallel' (1865); 'A Book for the Beginner in Anglo-Saxon' (1877); 'English Plant Names from the Tenth to the Fifteenth Century' (1880); 'Anglo-Saxon Literature' (1884); 'English Prose: its Elements, History and Usage' (1890); 'The Psalter of 1539: a Landmark in English Literature' (1894); 'A Simple Grammar of English Now in Use' (1897); 'The Alfred Jewel' (1901).

EARLE, Mortimer Lamson, American classical scholar: b. New York, 14 Oct. 1864; d. New York city, 26 Sept. 1905. He was educated at Columbia College; was instructor in Greek at Barnard College for six years beginning 1889, and was then appointed associate professor of Greek and Latin in Bryn Mawr College; 1898 to 1900 was lecturer in Greek at Columbia; and in 1900 was appointed professor of classical philology in Barnard College. Among other literary work he edited Euripides' 'Alcestis' (1895) and Sophocles' 'Œdipus Tyrannus' (1900). His lesser works were published in collected form in 'The Classical Papers of Mortimer Lamson Earle, with a Memoir' (New York 1912).

EARLE, Pliny, American inventor: b. Leicester, Mass., 17 Dec. 1762; d. there, 19 Nov. 1832. In 1785 he became engaged in the manufacture by hand of machine and hand cards for carding cotton and wool and invented in 1790 a machine for the manufacture of such cards by which the labor of one man for 15 hours could be performed in as few minutes.

EARLE, Pliny, son of the preceding, American physician: b. Leicester, Mass., 31 Dec. 1800; d. Northampton Mass., 18 May 1892. He was educated at the Friends' School, Providence, R. I., and was graduated as M.D. at the University of Pennsylvania in 1837. He was resident physician of the Asylum for the Insane at Frankford, near Philadelphia, 1840-42; physician to Bloomingdale Asylum, New York,

1844–49; elected professor of materia medica and psychology in the Berkshire Medical Institution at Pittsfield, Mass., in 1863, and was superintendent of the Massachusetts State Hospital for the Insane 1864–85. In the years 1837–39, 1849 and 1871, he traveled in Europe visiting the most important insane asylums. He is the author of 'Marathon and other Poems' (1841); 'Institutions for the Insane in Prussia, Germany, and Austria' (1853); 'An Examination of the Practice of Blood-letting in Mental Disorders' (1854).

EARLE, Thomas, American lawyer: b. Leicester, Mass., 1796; d. 1849. Early in life he removed to Philadelphia, where he was a member of the Constitutional Convention of 1837. His advocacy of the extension of suffrage to negroes antagonized many Democrats and in 1840 Earle was the vice-presidential nominee on the ticket of the Liberty party. Not succeeding in politics he abandoned it for literary work and subsequently published 'Essay on the Penal Law'; 'Essay on the Right of States to Alter and Annul their Charters'; 'Treatise on Railroads and Internal Communications' (1830); 'Life of Benjamin Lundy' (1844).

EARLE, William, English soldier: b. Liverpool 1833; d. 10 Feb. 1885. He received his education at Winchester, entered the army in 1851 and distinguished himself in the Crimean War. In 1872–76 he served as military secretary to Lord Northbrook, viceroy of India. He commanded the garrison of Alexandria in the campaign against Arabi Pasha and in 1884 was division commander in the expedition hurried to the relief of Gordon at Khartum. He was killed while leading his troops against Arab entrenchments at Kirbekan.

EARLHAM COLLEGE, a coeducational institution in Richmond, Ind., founded in 1847, under the auspices of the order of Friends. It is located on a tract of 120 acres, adjoining the western limits of the city of Richmond. The campus has an area of 40 acres, is shaded by native forest trees and is tastefully laid out with walks and drives. The college has eight buildings and grants the degrees of B.A., B.S. and M.A. The endowment amounts to about $750,000 and the value of buildings and grounds to about $375,000. The annual income is about $140,000. The total number of students in 1916 was 430, and the instructors numbered 30. The library contained 15,000 volumes.

EARLINGTON, Ky., city in Hopkins County, on the Louisville and Nashville Railroad, 55 miles south of Evansville, Ind. It is an important coal-mining centre and has extensive coke manufactories. The government is invested in a mayor, elected for four years, and a council of six members. The city has two public libraries. Pop. 3,931.

EARLY, John, American clergyman and publisher: b. Bedford County, Va., 1 Jan. 1786; d. Lynchburg, Va., 5 Nov. 1873. In 1807 he entered the ministry of the Methodist Episcopal Church. Among those who attended his early ministry were the slaves of President Jefferson. He was agent for Randolph-Macon College, 1833–40. When the Church divided he went with the Southern faction and aided in forming the Methodist Episcopal Church South. In 1846, he was elected the first publishing agent of the Church and began the business in Richmond, Va. In 1854 it was removed to Nashville, Tenn. In the same year he was elected bishop, serving until 1866 when he retired from active service.

EARLY, Jubal Anderson, American soldier: b. Franklin County, Va., 3 Nov. 1816; d. Lynchburg, Va., 2 March 1894. He was graduated from the United States Military Academy in 1837, fought in the Seminole War (1837–38), and having resigned from the service, entered legal practice at Rocky Mount, Franklin Co., Va., in 1838. A member of the Virginia house of delegates in 1841–42, he was also attorney to the Commonwealth in 1842–47 and 1848–52. During the Mexican War he was major (1847–48) of volunteers; and at the outbreak of the Civil War, although strongly opposed to secession, he received the appointment of colonel in the Confederate forces. Promoted brigadier-general for services as a brigade commander in the first Bull Run, he fought with distinction at Williamsburg, the second Bull Run and Antietam. He was in command of a Confederate division at Gettysburg, and in 1864 of an army for the invasion of Maryland. He crossed the Potomac, defeated Lew Wallace at Monocacy Junction (9 July), threatened an attack on Washington, D. C., but on the arrival of a considerable Union reinforcement, withdrew to the Shenandoah, possession of which he contested with Sheridan, then commanding the Federal army in the valley. On 19 September he was defeated at Opequon Creek, with the loss of 3,000 prisoners and five guns, and on 22 September at Fisher's Hill, where he lost heavily and from which point he was driven to the mountains. On 19 October he surprised the Federals in the morning at Cedar Creek, but the tide of victory was turned by Sheridan's arrival from Winchester, and he was completely routed. After his defeat by Custer at Waynesborough (March 1865), he was removed from his command. He attained lieutenant-general's rank. Subsequent to the war he practised law in Virginia, and was, with General Beauregard, a director of the Louisiana lottery. He never took the oath of allegiance. He is ranked high in the list of Confederate officers, and by some authorities was considered not inferior to "Stonewall Jackson." His chief publication is a 'Memoir of the Last Year of the War for Independence in the Confederate States of America' (1867). Consult 'Battles and Leaders of the Civil War,' edited by Johnson and Buell (1887).

EARLY ENGLISH ARCHITECTURE, the name generally given to the first pointed Gothic used in England. This style of architecture began to be used in England about the end of the 12th century and lasted for about 100 years. It immediately succeeded the Norman and finally merged in the Decorated style. It is characterized by long lance-shaped windows, which are often gathered into clusters and enclosed by a large arch, the space between which and the tops of the windows is often pierced with circular, trefoil or quatrefoil ornaments. The molding consists of alternate rounds and deeply cut hollows, separated by small fillets. The doorways are often divided

into two by a single shaft. The stones used were large and massive; the windows small. Later the entire structure was made lighter and thinner. The vaults were low and the flying buttress and arch were for the most part replaced by side-aisle roofs. Of this style are the choir of Canterbury (1175–84); Salisbury Cathedral (1220–58); and the choirs of Chester, Gloucester, Worcester and portions of the choirs of Ely and Winchester. Consult Moore, 'Medieval Church Architecture in England' (New York 1912); Prior, 'History of Gothic Architecture in England' (London 1900); Bondy, 'Gothic Architecture in England' (ib. 1907).

EARMARK, a slit or notch on one or both ears of cattle made when the calf was being branded and to serve as a means of identification. It was much used in the Western States of the Union in the halcyon days of the great ranches. Earmarks could be distinguished at a greater distance than the brand as the cattle when approached by a cattleman turned and faced him, thus permittting him to decipher the earmark readily.

EARTH, The. The earth is at once the subject and the object of many sciences. Of these the most elementary are geography and physiography, which deal primarily with the salient surface features of our planet. Next in order of difficulty are geodesy and geology, which deal more minutely with the shape, the size, the constitution, the mechanical properties and the material history of the earth. The science of meteorology is concerned with the phenomena of the atmosphere; and our theories of the tides and terrestrial magnetism must be added to the list of purely physical sciences of the globe. All of these sciences are intimately related, and they are sometimes grouped under the single term geophysics. In a broad sense, also, these sciences may be regarded as branches of astronomy for astronomy is founded on, and hence includes, geophysics. This article is written from the point of view of geophysics and deals especially with the physical and mechanical properties of the earth.

THE SHAPE AND THE SIZE OF THE EARTH.

First Approximation.— The form and the dimensions of the earth have presented a problem of the greatest interest and difficulty to men of science for more than 20 centuries and they promise to tax the resources of the ablest physicists for some centuries to come. The first approximation to a solution of this problem, of which we have definite record, was made by Eratosthenes of the Alexandrian school of astronomers. Assuming the surface of the earth to be spherical, he measured the length and the angular amplitude of an arc of a great circle extending from Alexandria to Syene. He observed that at Syene, which is about 500 miles south of Alexandria, the sun shone vertically downwards into deep wells at noon on the day of the summer solstice, proving thus that at that place and time the sun was in the zenith. On the same day at Alexandria he observed, by means of the gnomon, that the sun at noon was south of the zenith by one-fiftieth of a circle, or 7.2 degrees. The principles involved in these measurements and in the calculation of the size of the earth are very simple, but they are so fundamental as to justify a full explanation. They assume, first, that the earth is spherical in shape; secondly, that the plumb-bob at any point of the earth's surface is directed toward the earth's centre; and, thirdly, that the sun is so distant that lines drawn to it from different parts of

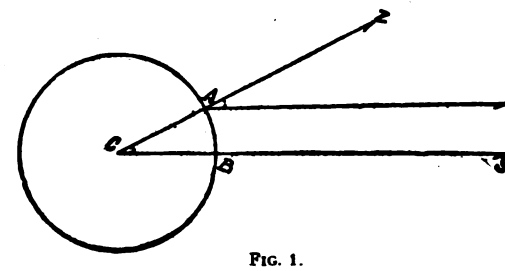


FIG. 1.

the earth are sensibly parallel. Thus, in Fig. 1, if A and B indicate the relative positions of Alexandria and Syene and C the centre of the earth, lines from A and C to the sun will be parallel; and hence the angle ZAS, or the meridian zenith distance of the sun at Alexandria, will be equal to the angle ACB. Knowing this angle and the distance AB, the rule of three gives the entire circumference.

Second Approximation.—No substantial advance beyond this first approximation was made until Newton showed that the gravitation and the rotation of the earth ought to make it somewhat flattened at the poles, or that the surface of the earth should have the shape of an oblate spheroid of revolution. The proof of this theoretical conclusion of Newton constitutes the second approximation to the figure and the size of the earth. Such a figure, however, is much more difficult of measurement than a spherical figure. This is seen by a glance at Fig. 2, representing an ellipse, which, if revolved about its shorter axis PP', will generate an oblate spheroidal surface. The principles of mechanics show that when such a surface is due to the attraction and the rotation of a fluid mass, the plumb line at any place will not in general point toward the centre of the

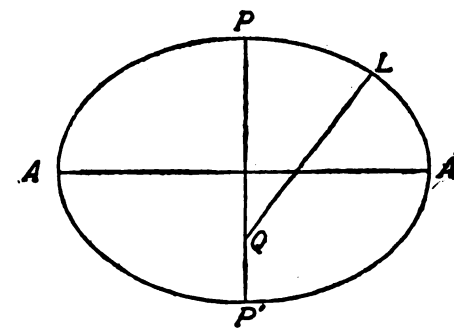
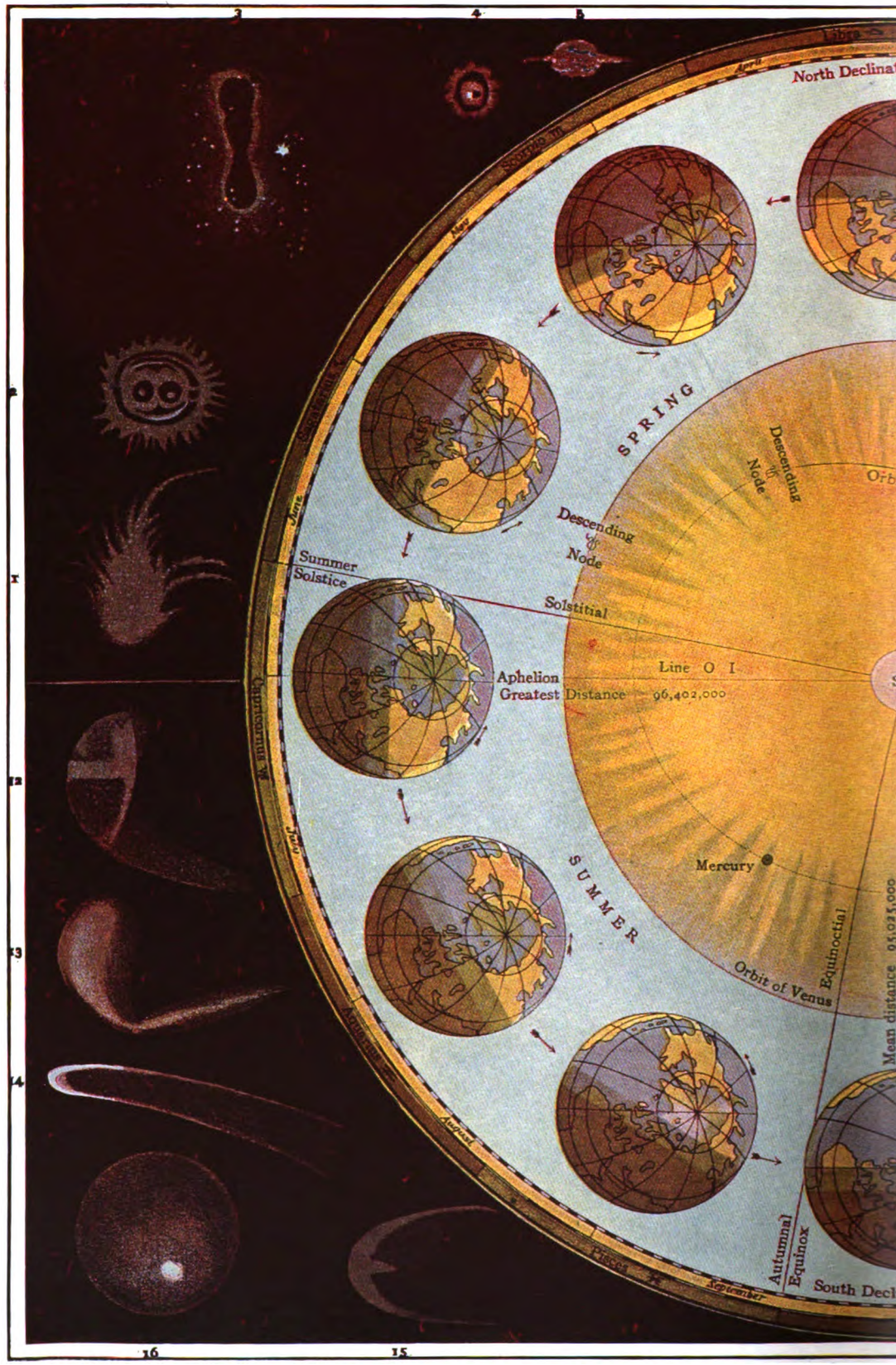


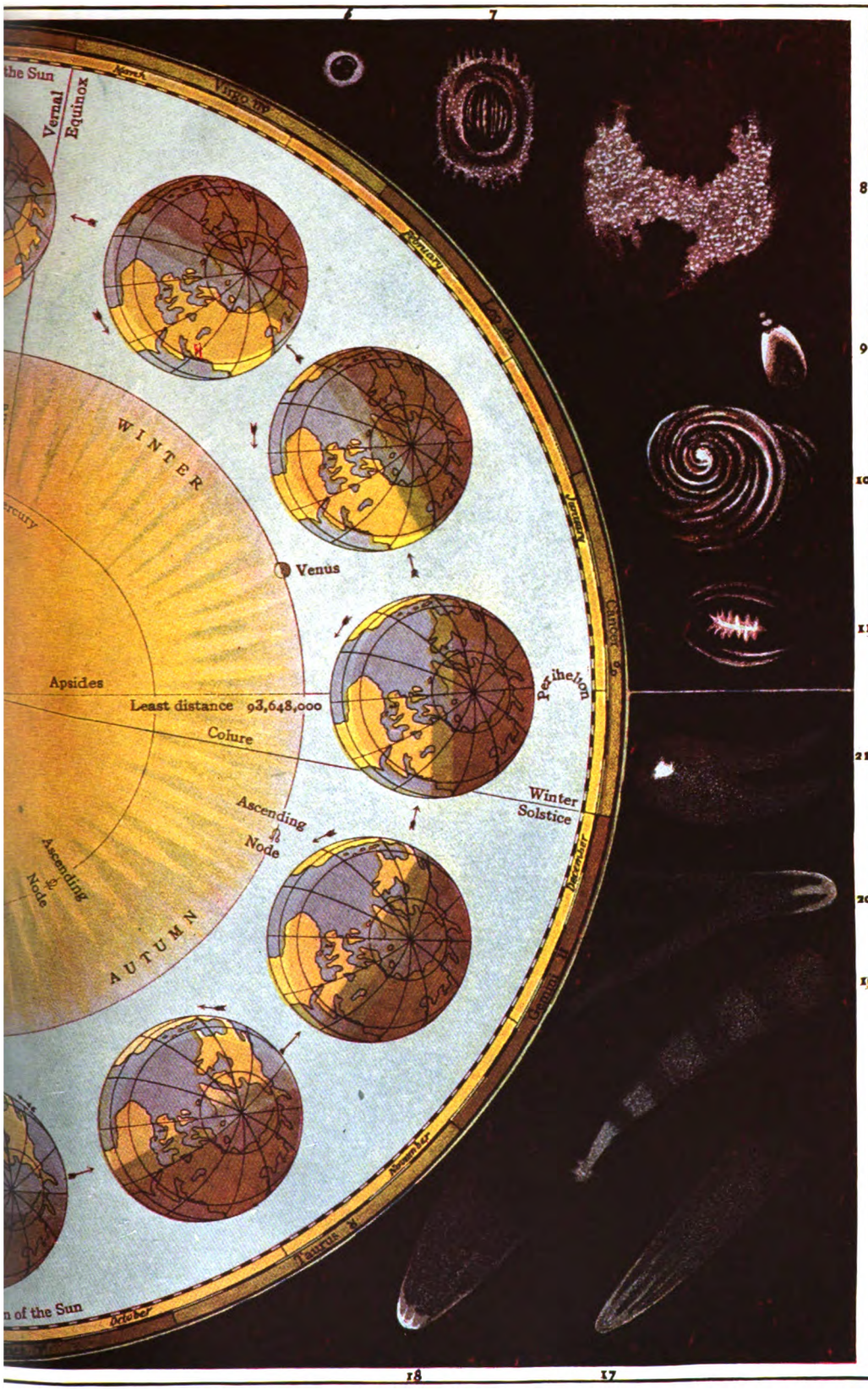
FIG. 2.

mass, but will pass somewhat to one side of it, as shown by the line LQ in the figure.

Newton's conception, therefore, involved the difficulties of the more complex spheroidal figure and of the hypothesis that the earth was primatively a fluid mass. Two ways of testing Newton's views were proposed. One was to



NEBULÆ. 1. The Crab Nebula. 2. Round Nebula. 3. Great Nebula in Argo. 4, 5, 6, 7. Nebulæ as shown b Rosse's Telescope. COMETS. 12, 13, 14. Halley's Comet as seen in 1835 at different periods. 15. Halley's Com parting from the sun. 19. Comet of 1680. 20. Come



rd Rosse's Telescope. 8. The Dumb-bell Nebula. 10. The Spiral Nebula. 9, 11. Nebulæ as shown by Lord
; departing from the sun, 1836. 16. Encke's Comet as seen in 1828. 17. Great Comet of 1811. 18. As seen de-
807 as seen by Bessel. 21. As seen by Schroeber.

measure the meridional lengths of a degree of latitude at different places on the earth's surface. If the earth is an oblate spheroid, it is seen from Fig. 3 that the meridional distance along the surface intercepted by two plumb lines which make an angle of one degree (or any constant angle) with each other is greater at the poles than at the equator, or in general, greater in high than in low latitudes. The other method proposed to measure by means of the pendulum the varying acceleration to which a body is subject in different latitudes on the earth's surface. If the Newtonian view is correct, that acceleration, which is the resultant of the effects of attraction and rotation of the earth, and hence the weight of a body, must increase in passing from the equator to the poles.

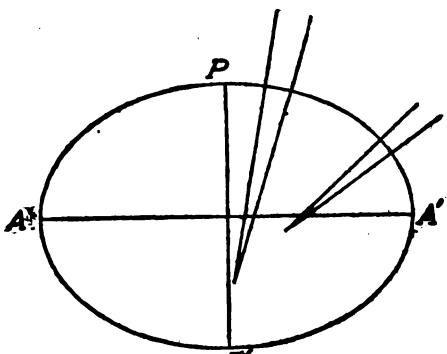


FIG. 3.

But the Newtonian theory was neither readily accepted nor easily verified. In the early part of the 18th century, in fact, the theory was hotly opposed by the justly distinguished Cassinian school of French astronomers, whose erroneous interpretation of a carefully measured arc of a meridian in France indicated that the earth is an oblong rather than an oblate spheroid. The question was permanently settled by the famous Lapland expedition sent out by the Academy of Sciences of Paris, in 1735, under the auspices of Maupertuis and Clairaut. They proved beyond doubt that the earth's surface is very closely that of an oblate spheroid, thus "flattening the poles and the Cassinis," as Voltaire remarked at the time.

A vast amount of labor has since been devoted to the determination of the dimensions of the spheroid which best fits the earth's surface. This is, indeed, the principal problem of the precise geodesy of to-day. The dimensions of the earth which have been provisionally very generally adopted are those of Gen. A. R. Clarke published in 1866. The theory of a spheroidal surface requires a knowledge of the lengths of the longer and the shorter axes of the generating ellipse, or equivalent data. Generally the half axes, or the equatorial and the polar radii, are given. The values of these are as follows:

Equatorial semi-axis = a, polar semi-axis = b.
a = 20,926,062 feet = 3,963.3 miles = 6,378,259 metres.
b = 20,855,121 feet = 3,949.8 miles = 6,356,635 metres.

It should not be inferred from these figures that the semi-axes are known to the nearest foot or metre. The values given above are those derived from computations carried out to the nearest foot. More approximate values will be determined from computations now in progress, and they may possibly show Clarke's values to be in error by a few hundred feet.

The following derived values appertaining to the earth's spheroid are often referred to:

Equatorial diameter of the earth	= 7,926.6 miles
Polar diameter of the earth	= 7,899.6 miles
Difference of diameters	= 27.0 miles
Circumference of equator of earth	= 24,902.0 miles
Meridian perimeter of earth	= 24,859.8 miles
Area of the surface of the earth	= 196,940,000 square miles = 510,071,000 square kilometers = 197 × 10^6 square miles (about) = 51 × 10^7 square kilometers (about)
Volume of earth	= 259,880,000,000 cubic miles = 1,083,200,000,000 cubic kilometers = 260 × 10^9 cubic miles (about) = 108 × 10^{10} cubic kilometers (about)

The following table gives the length of a degree of a meridian in different latitudes; the length of a degree in longitude measured along a parallel of latitude; and the areas of quadrilaterals of the earth's surface of one degree extent in latitude and in longitude. The latitude in the first column of the table is that of the middle point of the corresponding meridional arc or quadrilateral.

Latitude	Length of 1° of meridian	Length of 1° of parallel	Area of quadrilateral 1°×1° in latitude and longitude
	Statute miles	Statute miles	Square miles
0°	68.703	69.171	4752.3
10	68.725	68.128	4682.0
20	68.786	65.026	4472.8
30	68.879	59.956	4129.6
40	68.993	53.063	3661.0
50	69.115	44.552	3079.2
60	69.230	34.674	2400.5
70	69.324	23.729	1645.0
80	69.386	12.051	836.2
90	69.407	00.000	

From the second column of this table it is seen that the length of a degree of a meridian is about seven-tenths of a mile greater at the poles of the earth than at the equator.

Third Approximation.—A third approximation to the figure of the earth may be briefly referred to here. Imagine the mean sea-level, or the surface of the sea freed from the undulations due to winds and to tides. This mean sea surface, which may be conceived to extend through the continents, is called the geoid. It does not coincide exactly with the earth's spheroid, but is a slightly wavy surface lying partly above and partly below the spheroidal surface, by small but as yet not definitely known amounts. The determination of the geoid is now one of the most important problems of geophysics. Its solution will be accomplished by means of gravimetric surveys, or by measuring the acceleration of gravity at a great number of points on the earth's surface.

PHYSICAL PROPERTIES OF THE EARTH.

The Atmosphere.—Adopting the convenient terminology of geologists, the earth may be divided into four parts, namely: the atmosphere; the hydrosphere, or oceans; the lithosphere, or

crust; and the centrosphere, or nucleus. These are considered in turn without encroaching on the fields of the meteorologist or of the geologist.

The atmosphere is a gaseous envelope covering the earth to an extent not yet fully determined. The pressure it exerts at the surface of the earth is easily measured and is definitely known to be about 14.7 pounds per square inch, or about 1,033 grams per square centimeter.

The pressure, density and temperature of the atmosphere are observed to decrease rapidly with increase of height above the earth's surface, but the exact laws of decrease are not yet known. Hence it is impossible in the present state of science to assign a height to the atmosphere. It appears certain, however, that it is more than 200 miles high, since it is dense enough to set meteorites on fire at that height.

Many investigations of the properties of the atmosphere have been made during the past century. These are all too technical for presentation, even in abstract, here. But their results may be summarized as follows:

(a) If the earth did not rotate and if the atmosphere were of the same density throughout as at the earth's surface, its height would be 26,200 feet, or about five miles.

(b) If the earth did not rotate, and if the adiabatic law (pressure proportional to the 1.4 power of the density) held in the atmosphere, it would be about 17 miles high.

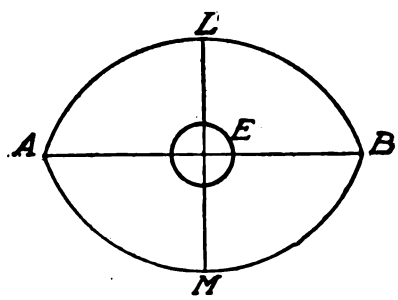


FIG. 4.

(c) But the earth rotates and the atmosphere must be supposed to rotate with the same angular velocity. From this fact, and from the assumption that the atmosphere behaves like a fluid, Laplace concluded that it must be limited by a lenticular-shaped envelope as indicated in Fig. 4. The revolution of this figure about the axis LM, which is supposed to be coincident with the axis of rotation of the earth, E, will generate the envelope and the earth in their true relative dimensions. The polar and equatorial axes LM and AB are, respectively, 4.4 and 6.6 times the diameter of the earth. According to this theory, therefore, the atmosphere may be about 17,000 miles high above the poles of the earth and about 26,000 miles high above the equator. The latter limiting height is that at which the centrifugal force due to rotation is just balanced by the attraction of the earth. The volume of the envelope is 156 times the volume of the earth. Whether the atmosphere actually extends to the limits thus defined has not been determined either by Laplace or by subsequent investigators.

A question of great interest is that of the quantity of the atmosphere, since the oxygen thereof is essential to the existence of all higher forms of life on our planet. By quantity is meant the amount of mass of the atmosphere. If the law of distribution of this mass within the Laplacian envelope were known the total quantity could be computed. But the law is not known, and hence it is only possible to attain an approximation, or to set limits, to the actual amount. A lower limit may be found from the adiabatic distribution of (b), above, for a non-rotating earth. This distribution does not differ widely from the actual distribution near the earth's surface; but since it is limited to a height of 17 miles it will give too small an amount. A computation on this basis makes the mass of the atmosphere 1-1170000th part of the total mass of the earth; or, in round numbers, one millionth part of the mass of the earth. This result is also reached, substantially, if it is assumed that the mass of the atmosphere is the same as the mass of a uniform layer of water, or mercury, which would produce the same pressure at the earth's surface. On the other hand, if the adiabatic distribution is supposed to hold within the Laplacian envelope, of (c), above, an upper limit of about 1-1200th of the mass of the earth is obtained. The actual value of the mass of the atmosphere is undoubtedly much closer to the lower than to the upper limit; how much closer is still a matter for investigation.

The Hydrosphere.— It is well known that about three-fourths of the earth's surface is covered by oceans and seas. Precise measures of the relative areas of land and sea are difficult to obtain, and the present state of knowledge does not justify the use of more than three significant figures in defining these areas. The values given below are derived from H. Wagner's 'Lehrbuch der Geographie.' They do not differ widely from the values given recently by other German authorities, though they make the total ocean area about 1 per cent greater than the earlier estimates of the distinguished British geographer, Sir John Murray. The table below gives the continental areas along with their average heights and the total oceanic area along with its average depth:

CONTINENT	Area in square miles	Average height or depth, in feet
Europe	3,860,000	980
Asia	17,100,000	3,120
Africa	11,500,000	2,130
North America	9,260,000	2,300
South America	6,840,000	1,970
Australia	3,440,000	1,310
Total continental area	52,000,000	2,300
Total oceanic area	145,000,000	11,480

The total area of the continents is, therefore, 26.3 per cent of the total surface of the earth; leaving, with the same degree of precision, for the total area of the sea surface 73.7 per cent of the surface of the earth.

The average depth of the oceans according to Wagner is 3,500 metres or 11,480 feet, or, in round numbers, 2.2 miles.

The data thus given show that the volume of the oceans is 315,000,000 cubic miles, or in

round numbers 1-800th of the entire volume of the earth. Assuming the density of sea water to be 1.03 times that of pure water, and the density of the latter to be 62.3 pounds per cubic foot, the mass in the oceans is found to be 1.49×10^{18} tons of 2,000 pounds, or one and one-half million million million tons.

It is interesting to contrast this mass of the oceans with the mass of the continents which lies above the sea-level. The average heights of the continents given in the above table require an average height for the entire land area of about 2,300 feet. This combined with the area of the continents gives for the volume of the continents above sea-level 22,500,000 cubic miles. If to this mass a density of 2.75 times that of water be attributed, the resulting mass of the continents above sea-level is 284×10^{18} tons. This is about one-fifth the mass of the hydrosphere or oceans.

The Lithosphere.— The lithosphere is the special province of the geologist, and is treated in detail under GEOLOGY. It is here considered, therefore, only in its broader physical aspects.

No precise value of the thickness of the shell which is called the crust can be assigned. The estimates of geologists make it 5 to 10 miles thick. It is the shell to which are confined the great rock movements and transformations with the attendant phenomena of crust crumpling, folding and faulting. For the present purposes it may be assumed to be 10 miles thick.

In its mechanical aspects the most important fact presented by the crust is that it rests on the centrosphere, or nucleus, in substantially the same manner as a fluid crust would. In other words, the crust is essentially, in view of the forces to which it is subject, a viscous mass, which may be likened in its behavior to sealing wax. This conclusion is reached when one compares the compression to which the crust would be subjected if it were self-supporting, like a dome, with the crushing strength of rocks. That compression is about 30 times the crushing strength of the finest steel and 500 to 1,000 times that of the best building stones. Hence we must infer that at a depth of a few miles there can be no such thing as a cavity in the crust. Another conclusion of great importance, also, is that the surface shape of the earth must conform very closely to the shape it would have if it had been originally fluid, as assumed by nearly all geodesists and geologists, many of whom adduce that shape as a proof of primitive fluidity. Given time enough, and the amount of time available is ample, as seen below, the viscous earth will assume the same shape, essentially, as a fluid earth.

Since the lithosphere, the hydrosphere and the atmosphere are the theatre of the principal activities, physical and biological, of our planet, it is of interest to know their volume, mass and chemical constitution. The volume of the shell 10 miles thick below sea-level is 1,969,400,000 cubic miles. Adding to this the volume of the crust above sea-level, namely, 22,500,000 cubic miles, there results for the volume of crust and hydrosphere down to a depth of 10 miles below sea-level 1,992,000,000 cubic miles. Of this, as stated above, 315,000,000 cubic miles are sea water, leaving for the solid matter of the crust to the depth in question 1,677,000,000 cubic miles. Attributing to this volume a density 2.75 times that of water, the mass of this solid part of the shell is 21×10^{18} tons of 2,000 pounds. This is about 14 times the mass of the oceans. These two masses and that of the atmosphere give, in round numbers, a total of 23×10^{18} tons, the contribution from the atmosphere being taken as 7×10^{18} tons.

Prof. F. W. Clarke, making use of the above data, has worked out the relative abundance of the chemical elements in the combined mass of the atmosphere, the hydrosphere and the lithosphere. His results are given in the following table. (Consult Bulletin of the United States Geological Survey, No. 78). It is interesting to note that nearly one-half of that part of the mass of the earth visible to us is oxygen, the next most abundant contributions being, in order, silicon, aluminum, iron and calcium.

CHEMICAL COMPOSITION OF THE LITHOSPHERE, HYDROSPHERE AND ATMOSPHERE.

ELEMENT	Solid crust	Oceans	Mean, including atmosphere
Oxygen	47.29	85.79	49.98
Silicon	27.21	.....	25.30
Aluminum	7.81	.....	7.26
Iron	5.46	.....	5.08
Calcium	3.77	0.05	3.51
Magnesium	2.68	0.14	2.50
Sodium	2.36	1.14	2.28
Potassium	2.40	0.04	2.23
Hydrogen	0.21	10.67	0.94
Titanium	0.33	.....	0.30
Carbon	0.22	0.002	0.21
Chlorine	0.01	2.07	0.15
Bromine	.....	0.008	.....
Phosphorus	0.10	.....	0.09
Manganese	0.08	.....	0.07
Sulphur	0.03+	0.09	0.04+
Barium	0.03	.....	0.03
Nitrogen	.....	.....	0.02
Chromium	0.01	.....	0.01
	100.00	100.00	100.00

The Centrosphere.— Since the crust of the earth, as seen above, rests like a viscous fluid on the centrosphere, the latter, whatever its temperature and other properties, must be subject to great internal stress. Indeed, the mechanics of celestial bodies of large mass leads inevitably to the conclusion that pressure is the dominant factor in the earth at no great depth below the surface. Given time enough, therefore, the distribution of pressure will be essentially the same as if the mass of the earth were fluid. This justifies the application of the laws of hydrostatics to the earth as a whole, whether it was originally fluid or not. With this concept, and with the law of gravitation, several facts enable us to determine within narrow limits what must be the constitution of the earth as regards distribution of density, gravity and pressure. The principal of these facts are (1) the surface density, (2) the mean density, and (3) the surface value of the acceleration of gravity. In addition to these facts, there are some others of less importance depending on the attraction of external bodies of the earth. Laplace correlated all these facts by means of a hypothesis with regard to the compressibility of matter. This asserts that the pressure in the earth increases as the square of the increase in density.

Adopting the indications of Laplace the fol-

lowing table showing the variation of density, acceleration of gravity and pressure with depth below the surface of the earth has been computed. The relatively unimportant effect of the rotation of the earth is ignored in the calculation. The assumed values of the surface density and the mean density are 2.75 and 5.5, respectively, times that of water. In the third column of the table g represents the average surface value of the acceleration.

DISTRIBUTION OF DENSITY, ACCELERATION AND PRESSURE IN THE EARTH.

Depth in fractions of earth's radius	Density relative to water	Acceleration of gravity	Pressure in millions of pounds per square inch
0.0	2.75	1.00g	.....
0.1	3.9	1.04	3.09
0.2	5.0	1.04	7.24
0.3	6.2	1.00	12.42
0.4	7.2	0.94	18.37
0.5	8.2	0.84	24.53
0.6	9.1	0.72	30.61
0.7	9.8	0.55	35.99
0.8	10.3	0.38	40.30
0.9	10.7	0.20	43.04
1.0	10.8	0.00	43.96

It is seen from this table that the acceleration attains a maximum value. This value is 1.05 times the surface value and it is attained at a depth of about 610 miles. At this depth a given mass would have a greater weight than at any other distance from the earth's centre. A more extended table, computed by the author from slightly different data, is given in the article on GEOLOGY.

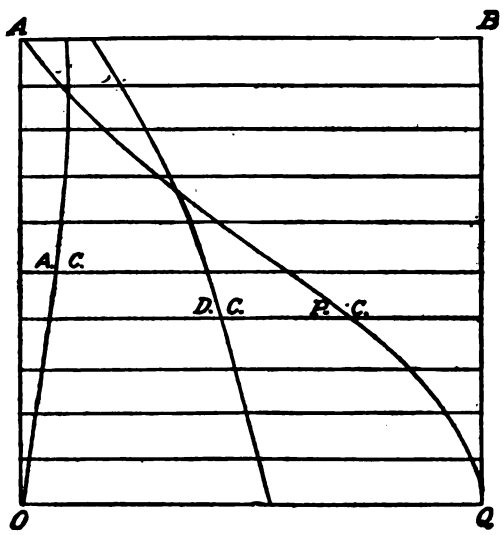


FIG. 5.

The variation of the density, acceleration and pressure are shown graphically in the following diagram, Fig. 5, in which these quantities are all measured horizontally from the line AO, representing the earth's radius, to the right. The curves have different horizontal scales and are designated, respectively, D.C. (density curve), A.C. (acceleration curve), and P.C. (pressure curve). The pressure curve intersects the axis OQ at right angles at Q.

Another interesting question in this connection is what total radial compressibility is compatible with this Laplacian distribution of density, acceleration and pressure. The answer may be stated in convenient form thus: If the pressure of the atmosphere were to be doubled the radius of the earth would be shortened everywhere by about 2 metres, or 6.5 feet. This explains how mere inequalities in surface loading of the earth may account for some of the great observed movements of the earth's crust.

The Rigidity of the Earth.— It cannot be doubted (as shown below) that the temperature of the nucleus of the earth is very high, probably sufficiently high, under normal conditions, to melt and even render vaporous the materials of which it is composed. But if the figures of the last column of the above table are examined, it will appear reasonable to suppose that the behavior of the central mass under such great pressures may be very different from that ordinarily associated with fluids. The first attempt directly to measure the rigidity of the ball of the earth was made by G. H. and Horace Darwin in 1880. They employed for this purpose a horizontal pendulum, but the results were not conclusive. Their method has since been successfully employed, however, by several observers (Ehlert, Hecker, Kortazzi, Schweydar and Orloff), who arrived at definite and consistent results. All of these observations, as well as the classic investigation of G. H. Darwin based upon the phenomena of the tides, concur in showing that the nucleus of the earth is solid throughout and that it is somewhat more rigid than if composed of steel.

A most promising investigation of the resistance which the earth offers to change of shape was recently begun by A. A. Michelson. (Consult *The Astrophysical Journal,* Vol. XXXIX). The method is based essentially on a very accurate measurement of the tides produced in the water level in two buried pipes, each 500 feet long, one running in an east and west and the other in a north and south direction. It is the intention to measure the variation with the interferometer, the observations being carried on continuously for a long time. Though this has not yet been done, the measures thus far having been secured with a microscope merely, it is evident that even the preliminary results are of a very high order of accuracy. They indicate that the rigidity of the earth, or its resistance to change of shape, is about one-third greater than the rigidity of steel.

Acceleration at Surface of Earth.— What is commonly called the acceleration of gravity at the surface of the earth is the resultant of the accelerations due to the attraction and to the rotation of the earth. This quantity has been measured with considerable precision at many points of the earth's surface by means of the pendulum, and the results have been combined in the following formula, g being the acceleration at any point of the sea-level whose latitude is ϕ:

$$g = 978.00 + 5.22 \sin^2 \phi \text{ centimeters / (seconds)}^2$$
$$= 32.087 + 0.171 \sin^2 \phi \text{ feet / (second)}^2.$$

Mean Density and Mass of the Earth.— Since the volume of the earth is known accu-

rately, the mass can be computed if its density can be ascertained. The author has recently shown (*The Astronomical Journal*, No. 424), that the product of this mean density and the gravitation constant may be derived with a precision comparable to that of the value of the acceleration just given above. The gravitation constant is the quantity essential to convert the proportionality of Newton's law of gravity into an equality. That is, if m and m' are two masses, D their distance asunder, F the force of attraction they exert on one another, and k the gravitation constant, then

$$F=k\frac{mm'}{D^2}.$$

It is thus seen that k is not a mere number, but a quantity such that the second member of the equation is force as well as the first member. k is, in fact, the cube of a length divided by the product of a mass and the square of a time.

Denoting the mean density of the earth by ρ, it is found in the paper referred to that

$$k\rho=36797\times10^{-11}\ /\ (\text{second})^2,$$

this quantity being the reciprocal of the square of a time. In a more interesting, as well as a more intelligible, form this relation may be written

$$\kappa\rho=\frac{3\pi}{T^2}$$

where π is the number 3.1415+ and T is the time it would take an infinitesimal satellite to pass around the earth under the law of gravitation, just grazing the equator, if there were no atmosphere to impede its progress. This time is seen to be 1 hour, 24 minutes, 20.9 seconds.

It is clear then that ρ will be given by the above equation if k is known. This quantity has been measured directly by several observers. A mean of the most recent and most trustworthy determination, is in C.G.S. units (see 'The Century's Progress in Applied Mathematics,' *Science*, N.S., Vol. XI),

$$k=6673\times10^{-11}. \ldots\ldots\ \ldots\ldots$$

Thus ρ is found to be 5.514 times the density of pure water. The uncertainty of this value as shown by the computation is about four units in the last place of decimals. In view of this fact, and of the great difficulties in measuring the quantity k, we shall use the round number 5.5 as hitherto.

From the volume of the earth given above the following results are derived for its mass:

Mass of earth $\left\{\begin{array}{l}=1.311\times10^{21}\text{ pounds}\\=6.552\times10^{18}\text{ tons (of 2,000 pounds)}\\=5.945\times10^{24}\text{ kilograms}\end{array}\right.$

For convenience of reference the masses that have been given above are here collected and expressed in tons of 2,000 pounds.

Mass of earth	$=6{,}550\times10^{18}$
Mass of centrosphere	$=6{,}529\times10^{18}$
Mass of lithosphere	$=21\times10^{18}$
Mass of hydrosphere	$=1.49\times10^{18}$
Mass of atmosphere	$=7\times10^{15}$

The Internal Heat of the Earth.— That the earth has a great store of heat a few miles below the surface is amply proved by a variety of geological phenomena. Wherever deep wells, or bore holes, have been sunk the temperature is observed to increase with depth at a rate of about a degree F. for 60 feet. This shows that heat is being conducted from the interior to the surface of the earth and is thence radiated into surrounding space. The amount of this heat is sufficient to melt a layer of ice six to eight millimeters (or one-fourth inch, say) thick, covering the globe, per annum, or more than 800 cubic miles of ice. It seems most probable (though it is by no means certain) that the temperature of the centrosphere is high enough to melt all known rocks, although the lower strata of the crust do not assume the molten or viscid form of lavas except on relief from the great pressure to which they are subject. This was, essentially, the view of Fourier, the earliest physicist to investigate this question, and it is still regarded as the most plausible hypothesis with respect to the actual state of the earth.

Whether this hypothesis is exact or not, however, the theory of heat conduction founded by Fourier enables us to draw with certainty two important conclusions with respect to the earth, namely: (a) that the heat conducted from the interior to the surface escapes as if there were neither atmosphere nor oceans; and (b) that a million years is the smallest unit of time convenient for measuring the historical succession of thermal events.

With less certainty it may be affirmed that the earth is shrinking in bulk as it cools, and that this is one of the principal causes of the grand crust crumplings and volcanic activities to which geologists pay special attention. This cubical contraction goes on exceedingly slowly, however; requiring, so far as one can infer from present indications, nothing short of thousands of millions of years for its completion.

The Earth as a Time Keeper.— The time of rotation of the earth is the most trustworthy unit of time man has discovered. The present value of this unit is 86164.1 mean solar seconds. That the earth must rotate with great steadiness is at once apparent when the immense amount of its energy of rotation is considered. This energy is about 156×10^{27} foot-pounds, or 2×10^{36} ergs. It is more than will be developed at Niagara (at the present rate of 5,000,000 horse power, say) in a million million years. Nevertheless, the period of rotation of the earth is subject to variation from four obvious causes. These are (1), secular contraction of the earth's mass; (2), the influx of meteorites, or meteoric dust; (3), tidal friction; and (4), shiftings in position of the surface load of the earth, as in the processes of sedimentation, glaciation, etc.

The effects of the first two causes have been investigated. (*Astronomical Journal*, No. 502). Contraction tends to shorten the day, and may possibly cause a diminution of as much as 6 per cent of the present length. The change goes on very slowly, however, and will not be perceptible in any such interval as that of human history (20 centuries, say). Meteoric dust tends to lengthen the day, but at the present rate of influx (about 20,000,000 meteorites daily) the effect will not amount to so much as a quarter of a second in less than a million million years. During this interval of time the total effect, substantially, from secular contraction will have accrued.

The effects of the other causes named have not been evaluated, though the last one is probably the most important of all of them; since

it may be easily shown that such shiftings of the surface load as are now taking place on the earth may modify the length of the day by an amount which, if cumulative, might in a few centuries seriously disturb astronomical reckonings.

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EARTH-HOUSES, a name generally given throughout Scotland to underground buildings, also known as "Picts' houses" or "Picts' dwellings." The earth-house in its simplest form consists of a single irregular-shaped chamber, formed of unhewn stones, the side walls gradually converging toward the top until they can be roofed by stones of four or five feet in width, all covered in by a mound of earth rising slightly above the level of the surrounding district. In the more advanced form of these structures two or three chambers are found. Earth-houses are frequent in the northeast of Scotland, occasionally 30 or 40 being found in the same locality. Very similar structures, known as bee-hive houses, occur in Ireland. In the United States modern earth-houses are to be found in Nebraska, Kansas and other Western States, and are commonly called "dug-outs." In Arizona and California certain dwellings of adobe may be designated as earth-houses. See ADOBE.

EARTHENWARE, vessels or objects of clay, as distinguished from porcelain, is opaque; as distinguished from stoneware the body is dull and earthy. The clay is baked or fired in a kiln, or more rarely sun-dried. The glaze depends on the quality of the ware; generally it is of a readily fusible character and contains lead; but a simple salt glaze is employed for common articles. Occasionally the unglazed body is employed, as for water-bottles, cream-jugs, vases and ornaments; these have generally a reddish brown color, due to iron. The finer kinds of earthenware, such as Majolica, Delft ware, Faience and Palissy ware, are not only glazed, but are besides elaborately colored and enameled and ornamented with raised figures of various kinds. See FAIENCE; POTTERY.

EARTHLY PARADISE, The, the great narrative poem of William Morris, was written in the years 1865 to 1870, the height of his career as craftsman and business man. The scheme that holds together this strange medley of Greek myth, Norse saga, French romance and Arabian tale is amazingly simple. The scene is laid at the end of the 14th century in "a nameless city in a distant sea," inhabited by descendants of the Greeks. Hither came a band of Norse wanderers, driven into years of voyaging by those two recurring mediæval motives: fear of the dread Black Death and hope of an Earthly Paradise, of endless life. Here the wanderers linger on, finding, not immortality, but rest, and at last, release from fear; and here, month by month, each company tells the other a tale — one classic, one mediæval, till the 24th ends the year. This scheme is successful, not only because out of the most diverse material it builds a single, simple structure, but because it justifies an equally single and simple treatment. Differences of tone there inevitably are. Such a tale as "The Lovers of Gudrun," taken direct from an Icelandic saga, moves with a swift relentlessness, a tragic intensity; "The Land East of the Sun and West of the Moon" carries out the dream device in its dreamlike leaping and lingering. But the unity that links such variety as "Cupid and Psyche" and "The Man Who Never Laughed Again" (from the 'Arabian Nights') goes deeper than any narrative scheme or recurrence of metric form. It is the spirit of Morris himself — master story-teller — that unites these stories of lovers fair and strong, of great things dared and endured. And for those who weary of this endless revel of love and adventure, of sunshine and color, there is the subtler lyric beauty of the interludes, in which the artist's own imagination is most surely revealed. It is not simply that these brief interludes — one for every month — are among the loveliest of English landscape poetry; but that in them, from the famous Prelude to the moving Envoi to his master Chaucer, the poet utters his deepest feeling about his life and his art. A "dreamer of dreams, born out of my due time," a hater of death, "not knowing what it meant," but a lover of life, "through green leaf and through sere," he has learned with his wanderers and his Norse heroes to face life and death heroically. Consult 'The Collected Works of William Morris' (ed. by May Morris, London 1910); Mackail, J. W., 'The Life of William Morris' (2 vols., 1904).

FRANCES CUTLER.

EARTHNUT, a common name for many unrelated plants. The most common are probably the following: *Bunium flexuosum* and *B. bulbocastanum*, both members of the natural order *Umbelliferæ*, the latter referred by some botanists to the genus *Carum* (caraway). Certain species of *Carum, Oenanthe* and *Chærophyllum* of the same natural order, also bear this common name. All these species are natives of Europe and all bear tubers which have been used to some extent for human food, but are more valued as food for swine, since the animals can be turned loose to root them out of the ground. They are also known as earth chestnuts, pig-nuts, etc. Certain species of *Cyperus* of the order *Cyperaceæ* are also called earthnut (See NUT-GRASS), and so are various species of the natural order *Leguminosæ*, especially *Arachis hypogæa* (see PEANUT), *Apois apios*, or *tuberosa* (see GROUND-NUT), known also as wild bean.

EARTHQUAKE. Earthquake denotes a shaking of the earth's crust, due to the passage of elastic waves, depending on some internal cause. These waves are principally of two classes: longitudinal, in which the particles vibrate as in sound; and transverse, in which they vibrate as in light; but near the origin of disturbance both classes of vibrations coexist

and the movement of the earth particle is a combination of the two oscillations. A cubical element of the earth's crust has its volume compressed and its form distorted, with the passage of each successive wave and the rapid recurrence of this movement constitutes the trembling called an earthquake. The velocity of this wave propagation varies according to the elasticity and average density of the rock, the observed values lying between a few hundred feet and about five miles per second, as in the recent San Francisco earthquake, which was propagated across the continent with great speed. Powerful earthquakes are now recorded all over the world by means of very sensitive seismographs and it is found that the greater the distance of propagation the more the waves are separated, the compressional waves outpacing the distortional ones.

The record of a South American earthquake, like that of Valparaiso, 16 Aug. 1906, occupies from two to three hours when registered upon seismographs in the United States and Europe; and moreover the further the disturbance is propagated the slower the earth movement becomes, so that from a violent agitation near the origin it becomes a gentle swaying of very slow character in the distance and may not be felt by men nor animals, though faithfully recorded on delicate long-distance seismographs. As more than 60 world-shaking earthquakes occur each year, one of these disturbances on the average is due each week and by the investigation of the propagation of these waves through the earth seismologists have drawn important conclusions regarding the constitution of the globe. In this way Mr. R. D. Oldham shows (*Quarterly Journal of Geological Society*, 1906) that the earth is fairly homogeneous throughout until we reach a distance of about 0.4 of the radius from the centre, when a change takes place, the cause of which is not yet understood.

Moreover, it is possible for a seismologist to calculate from his record of an earthquake how far off the disturbance was. The empirical formula given by Professor Omori of the Imperial University at Tokio, for very distant earthquakes is as follows (*Publications Astron. Soc. Pacific*, 10 June 1906):

$$X^{Km.} = 6.54 Y^{Sec.} - 720 km.;$$

where X, in kilometers, denotes the actual distance between the centre of disturbance and the place of observation; and Y, in seconds, the total duration of the first and second preliminary tremors. When the distance is small the formula becomes

$$X^{Km.} = 7.27 Y^{Sec.} - 38 km.;$$

From the records obtained at the Lick Observatory Professor Omori calculates that the most central part of the San Francisco earthquake was 80 or 90 miles to the west of Mount Hamilton, which places the origin under the margin of the Pacific Ocean.

The motion of the earth particle usually is only a small fraction of an inch and houses resting on solid ground do not suffer greatly; but where the land is made by the filling in of soft earth it remains loose and by the passage of the earthquake waves is thrown into billows like the sea, so that all structures on such foundations are frequently destroyed. This was observed to be the effect at Lisbon as long ago as 1755 and illustrated again very clearly at San Francisco and at Valparaiso in 1906. Even the steel frames of brick buildings were destroyed on the made land at Valparaiso, though houses standing on rock foundation suffered but little. Observations by Professor Omori and the writer at San Francisco show that on the made land the oscillations did not exceed about three inches. Owing to the rapidity of vibrations of this amplitude, however, few structures are able to withstand them. But on hard ground, where the vibrations were about a quarter of an inch, the worst that would result would be a cracking of the plastering and perhaps of the walls.

There are many modern investigators of earthquake phenomena. The names of Milne, Omori, Dutton, Oldham, Wiechert and many others are familiar; and in Europe and Japan many earthquake observatories are in active operation. Several such observatories have been established in the United States and now that the Seismological Society of America has been founded at San Francisco, no doubt the study of earthquakes will become an important object of attention. The Seismological Society of Japan has done much for the investigation of earthquakes in the Orient and elsewhere.

The distribution of earthquakes is very similar to that of volcanoes, but there is a quite definite earthquake zone encircling the whole earth, only a part of which is distinguished by volcanic activity. This zone includes the Mediterranean Sea, the Azores, the West Indies, Central America, Japan, China, India, Persia and Asia Minor. This may be regarded as a main earthquake zone from which there are many branches following the coast line of the continents and thus, in general, nearly coinciding with regions of volcanic action. In many cases it is, indeed, evident that volcanic eruptions and earthquakes which accompany them are closely related, both being due to explosions of steam, with a consequent readjustment of pressures and material within the immediate region. A great volcanic eruption is thus usually preceded by earthquakes which are frequently felt for a great distance from the volcanic zone; upon the actual commencement of the eruption, however, the earthquakes diminish greatly in intensity or wholly cease, doubtless because the interior steam pressure has been relieved by a passage through the outlet formed. Yet these disturbances are only very local compared with the effects of really great earthquakes. Nor is it true that a very large proportion of the heavier earthquakes, even in these regions, are closely associated with volcanic activity; the original centre of the disturbance is usually found to lie at a distance, where there are no volcanic rocks.

A second and more widespread cause of earthquakes is a sudden settling, faulting or bending of the earth's crust owing to the strains which are set up within it. The slow secular contraction of the earth's interior must set up such strains in the material resting upon it; though the rocks may withstand this strain for a considerable period, yet ultimately they may suddenly give way, causing a rock fracture many miles in length, the rock on one side sinking down and causing a "fault,"—or there may be a general jarring subsidence under a territory of

considerable extent. These phenomena are most frequent along the greater mountain ranges which border the oceans and are closely associated with regions of present folding and upheaval or subsidence of the earth's crust. Both they and volcanoes are obviously associated with lines of weakness in the crust of the earth. Similarly, earthquakes may be produced by continued deposition of sediment on an ocean bed, which latter being overloaded (and possibly heated and thus weakened by the superimposed material), may suddenly yield.

We have thus far no accurate data for estimating accurately the number and situation of earthquakes which occur under the sea but disturbances there are not unfrequently more violent than under the land. One of the most frequent phenomena noticed to accompany severe earthquakes along the ocean shores is the violent disturbances of the sea, giving rise to enormous waves which sometimes prove more disastrous than the earthquakes themselves. These seismic sea waves are divided into two classes: First, those in which the water is noticed slowly to withdraw from the shore some time after the earthquake and later return as a great wave carrying everything before it; and second, those in which the water rises suddenly and overflows the coast, without any previous recession from the shore. In the first class are to be included the waves which inundated Lisbon after the great earthquake of 1 Nov. 1755; Callao, 28 Oct. 1746; Conception, 20 Feb. 1835; Arica, 13 Aug. 1868; and Iquique, 9 May 1877. In all these cases the water retired some little time after the earthquake, say from a quarter to half an hour and sometimes after longer intervals; and moreover the withdrawal is gradual, so that ships at anchor simply settle down upon the sea bottom laid bare by the slow withdrawal of the water. Then after an interval of 20 minutes, or half an hour, the sea returns as a great wave, which is said to have been 80 feet high at the overflow of Callao in 1746 and from 50 to 60 feet high at the inundations of Arica and Iquique. The wave is naturally made higher with a more vertical front as it approaches the shore, owing to the resistance to propagation in shallow water.

The slow draining away of the water some time after the earthquake shows that the sea bottom has sunk and the water rushes in from all sides to fill up the depression; the currents meet at the centre and raise a ridge where there was formerly a depression and the ridge then collapses and sends ashore the first great wave. After this has swept the shore the sea slowly withdraws again to fill up the depression, leaving bare the land as before and after the same interval again returns and sweeps the coast. At Arica in 1868 and at Iquique in 1877 it is said that the sea continued to oscillate for nearly two days before it finally quieted down and meanwhile the waves were propagated around the world.

In seismic sea waves of the second class, where the water rises suddenly without recession from the shore, the cause is an upheaval of the ocean bed, which also lifts the water resting upon it. The result is the sudden appearance of a great wave. This class of waves appears to be less frequent than the preceding class and therefore is not so famous as those in which the water first withdraws from the shore. At great distances from the origin, waves of the first class, in being propagated round the world, resemble those of the second class; so that to classify sea waves intelligently a careful investigation must be made of the place of origin of the disturbance.

A quite different theory of earthquakes, which includes also the cause of volcanoes and the mode of mountain formation, has recently been very fully developed by Prof. T. J. J. See. This is in brief, that under the enormous pressures existing at the bottoms of the ocean beds a portion of the water is forced downward to a considerable depth within the earth's crust; here, becoming diffused among the molten rocks and having its explosive power greatly increased through superheating, it penetrates under the lands along the coast lines where it may elevate mountain ranges parallel to the coast, giving rise in its explosive pressure to faults, volcanic outbreaks, and, as a consequence of each of these, to earthquakes. Admitting the possibility of water penetrating the crust in this way, this theory explains the situation of the great mountain ranges of the earth, the general absence of seismic disturbances beneath the interior of continents (since here the seepage of the water would be less), the observed fact that the density of mountain masses is often small and many other associated phenomena. Consult 'The Cause of Earthquakes, Mountain Formation and Kindred Phenomena Connected With the Physics of the Earth,' (Proceedings of the American Philosophical Society, 1906).

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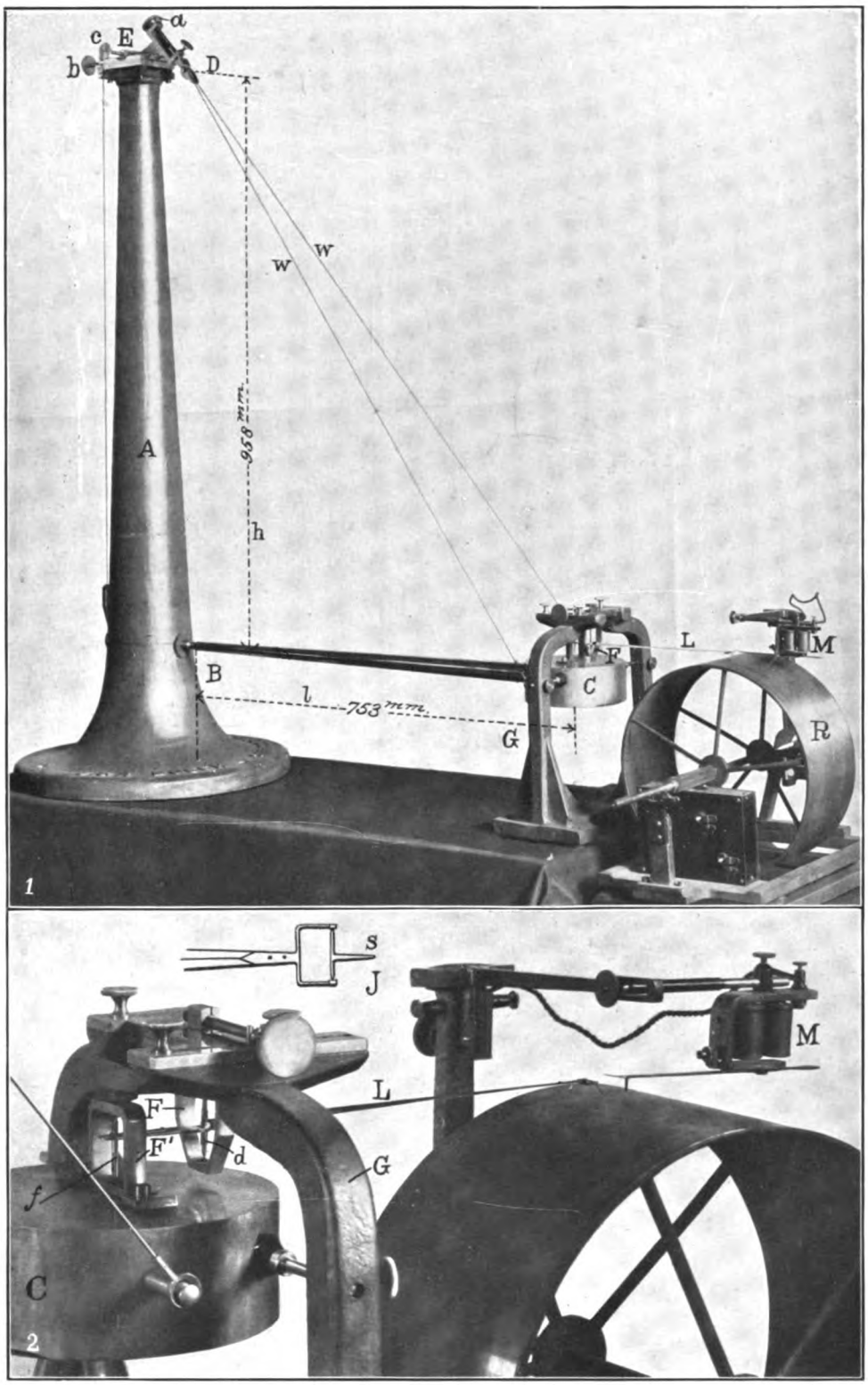
EARTHQUAKES, Instruments for Recording. The first record of an earthquake really worthy of being regarded as accurate and complete was obtained by Prof. James Ewing at the University of Tokio, on 3 Nov. 1880, by the aid of a new seismograph of his own invention. This great epoch-making result was dimly foreshadowed, no doubt, by earlier crude attainments, yet Ewing's work was far in advance of that of the times, and his records were the first and only ones from which the approximate amplitudes, periods, and accelerations of the motions of the ground could be deduced.

In order that a seismograph may faithfully record the motion of the ground during an earthquake it is in general a necessity that some portion of the instrument must remain relatively at rest throughout the disturbance. It



1 Horizontal Pendulum Seismograph with Mechanical Registration
2 Details of Horizontal Pendulum Seismograph

seems to the writer that to Ewing more than any other is due the credit of having formulated the kinetic basis of all modern seismometry. He was the first to show how to realize and utilize the principle of the steady mass in the measurement of earthquake motion. There is scarcely any type of seismograph now in use that does not find its prototype among the large number of devices and arrangements either described or actually constructed and employed by Ewing at the University of Tokio from 1880 to 1883. We cannot attempt to describe in this brief account any of his early work,[1] or the equally important contributions to seismology by Milne, Gray and others[2] of that period.

Within the past 25 or 30 years seismographs have multiplied very greatly throughout the civilized world, and by their records it is found that any considerable earthquake literally sets the entire crust of the globe vibrating and its tremors are measurable at almost any point on the surface by the aid of the sensitive instruments now employed.

Nature of Earthquake Motion.— A short statement explaining the motions of the ground will aid in understanding the instruments and their records. The commonly current conception that earthquake motion is a comparatively simple vibratory displacement of the ground in some particular direction is shown to be decidedly erroneous by the actual records. The motion, in fact, is exceedingly complex; the vibrations in a horizontal plane take place in all conceivable directions and are compounded with motion in the vertical. With this complex sort of vibratory displacements there may also coexist certain twisting and tilting rotations. No single instrument can possibly produce the record of such highly intricate motions. They must be separated or resolved into elementary components for satisfactory registration. It is generally recognized that no less than six distinct and separate components require to be measured, namely, three displacements in directions at right angles to each other, that is, one north, and south, one east and west and one vertical; also, three components of rotation about the same three axes. The turning on the vertical axis may be called a twisting component. The turnings on the horizontal axis are tilting effects. Seismologists have not yet succeeded in recording all of these elementary components. Unfortunately most of the instruments thus far employed are influenced by more than one component of motion, and the records cannot therefore be entirely interpreted.

Seismographs.— The seismographs chiefly employed up to the present time are those designed to register the horizontal vibratory displacements of the ground. In a limited number of cases efforts have been made to register the vertical component of motion. In still fewer cases the tilting motions of the ground have been the subject of special measurements. The writer is not aware that the twisting component has thus far ever been recorded, although forms of apparatus for the purpose have been proposed.

Vertical Component.— Instruments for vertical motion are not so easy to design, and the results obtained by their use have been less satisfactory than with other types either because the vertical motion of the ground is relatively very small, or because it may be absent altogether. In seismographs for vertical motion the so-called steady mass must, in general, be suspended by means of very flexible springs, or their equivalents, in order that it may remain at rest in the vertical sense while the ground may rise and fall beneath it. If the springs are too stiff the steady mass fails to remain at rest but is made to rise and fall with the movement of the ground. On the other hand, if the springs are too weak, very slight variations of strength, due to temperature and prolonged excessive stress, cause the steady mass to wander slight amounts from its normal position of rest. As the motions are generally greatly magnified, these slight progressive displacements often carry the tracing entirely off the sheet designed to receive it, or otherwise prove fatal to the desired result. These characteristics of ordinary springs constitute serious limitations in the construction of seismographs for vertical motion. What is needed in this connection is some sort of available material for springs that, under very great extension, does not exhibit with the lapse of time any minute slow, progressive, after-deformations and is unaffected by variations of temperature.

Horizontal Motion.— A simple pendulum consisting of a massive bob, weighing several hundred pounds in some cases, suspended by a steel wire from a massive support has been extensively employed especially in Italy and Spain as the "steady mass" for a seismograph. The motions of the ground with respect to such a mass must be magnified from 10 to 100 or more times if we are to produce satisfactory records of small distant earthquakes. The means of doing this will be shown later.

A simple pendulum of this character fails to provide a reliable steady mass for two or three reasons. If the length is short, 10 or 20 feet, the mass very quickly responds to the earthquake movements and presently the pendulum is itself swinging in a more or less violent manner. A long pendulum (several hundred feet) cannot be supported with sufficient rigidity. The top of a lofty tower, even during the absence of an earthquake, wanders all about a fixed point within it, due to the influence of temperature, wind, etc., on the tower, and the effects of moisture, temperature, rainfall, etc., upon its foundation and the adjacent earth. During an earthquake the motions of the top of such a tower cannot be the same as those of the ground and are doubtless much greater, thereby seriously influencing the steady mass, notwithstanding the great length of its support.

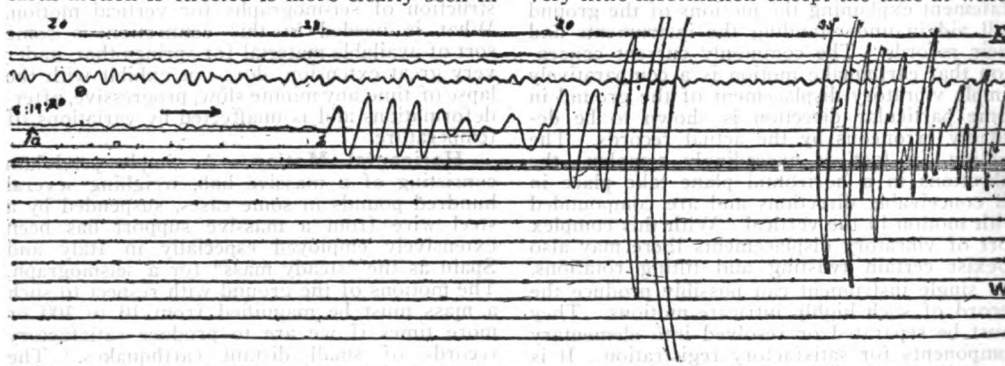
The Horizontal Pendulum.— The type of pendulum employed first by Ewing for the measurement of earthquake motion in the horizontal plane is commonly called the horizontal or conical pendulum. A modern design of this form of seismograph is shown in Figs. 1 and 2. The steady mass C (about 40 pounds) is supported upon the massive column A by a horizontal strut and the diagonal wires W. W. so that it is exceedingly free to swing about a

[1] Memoirs of the Science Department, University of Tokio, No. 9.—1883.

[2] Publications of the Seismological Society of Japan, since 1880.

pivot point at D and another at B. The two points D and B are not quite in a vertical line, hence the steady mass is in slightly stable equilibrium and if disturbed oscillates like a very long pendulum. As ordinarily adjusted at the Weather Bureau the pendulum illustrated, makes a complete oscillation in about 35 seconds. This is equivalent to a simple pendulum about 4,000 feet long. The record is made upon the clock-driven drum R by means of the lever L, carried in the heavy yoke piece G. For this purpose the surface of the drum is closely covered with a piece of smooth white paper which is uniformly coated with soot from a wide-flame, smoky, kerosene lamp. The drum makes one revolution an hour, and each minute of time is electrically marked on the record sheet by the time-ticker magnet M. The distant end of the drum-shaft is cut with a coarse thread which causes the drum to move endwise about 3-16 of an inch with each revolution, thus separating the lines traced by the stylus.

The manner in which the registration of the earth motion is effected is more clearly seen in



Record of San Francisco Earthquake as made by the Seismograph at the U. S. Weather Bureau, Washington, D. C.

Fig. 2. The lever L is pivoted very freely in the stirrup F. The short end of the lever is forked and engages the slender steel staff *f*, which is pivoted in the most delicate manner in the frame F, rising from the steady mass C. Observing now that the steady mass is free to remain at rest with respect to the lateral motions of its pier and the yoke piece G, it is plain that the stylus at the long end of the lever will trace a magnified record of all the lateral displacements of the pivot *d*, because the point of the fork which engages the steady mass at *f* must remain at rest with the mass. The amount of magnification depends upon the ratio of the lever arms. In instruments of the kind illustrated a 10- or 15-fold magnification is usual. Owing to the fractional resistance offered by the soot and at the pivot points greater magnifications require proportionately greater mass in the pendulum, if the same period is retained.

Very similar devices to those shown are quite generally employed in all instruments with mechanical registration.

Two separate pendulums installed at right angles to each other are required to register both components of horizontal motion.

Photographic Registration.— Much less massive horizontal pendulums can be employed to register photographically by the aid of light reflected from a mirror in the usual manner. The Milne seismograph used in the English work records photographically without the use of mirrors. A small steady mass is suspended on a horizontal strut only an inch or two long, but the strut is prolonged beyond by a very light boom to a length of nearly three feet or more. This long boom at the outer end carries a light aluminum vane pierced with a narrow radial slit. The photographic paper, in the shape of a long ribbon, is placed in a box just under the vane. The box has a slit in its top at right angles to that in the vane. Light from a lamp is thrown upon the aluminum vane and passes into the box at the point where the two slits intersect, thus making the photographic record.

Magnetographs.— It has been found that the delicately suspended magnetic needles employed for the purpose of recording continuously the small diurnal and other changes going on in the earth's magnetism are nearly always disturbed by even very small earthquakes. These are not seismographs at all, in the ordinary meaning of the word, and the records give very little information except the time at which the needles were disturbed. The needles act like any other small, light pendulum and simply suffer certain mechanical agitation during the earthquake. In some less frequent cases there appear to be certain distinct magnetic effects that occur with the earthquake, but these are only imperfectly understood at the present time.

Interpretation of Records.— Serious complications are likely to enter into the records of seismographs especially of the horizontal pendulum. This instrument is more and more sensitive to minute tilting motions the greater its period of oscillation. If the ground at the Weather Bureau instrument tilts as little as only one inch in a mile the stylus of the seismograph will be thrown out of the line nearly one-quarter of an inch. Furthermore, the instrument is sensitive to the twisting component of motion and finally we cannot feel entirely sure the steady mass has remained quite at rest. If the earthquake motion synchronizes with the free motion of the pendulum, the latter is quite certain to be set swinging. In the face of these complications it is hardly possible, as yet, to interpret exactly the records obtained. Great improvements in the instruments are constantly being made and it appears as if the horizontal pendulums are likely to be displaced in the future by better types of apparatus.

Records.— The interesting features of the Weather Bureau record of the San Francisco earthquake appear in Fig. 3. The small preliminary tremors began "at 8 h.— 19 m.— 20 s., A.M., that is 6 minutes 42 seconds after the strong motion recorded at the University of California. The stronger motion begins at "b", on the record at Washington and at 8:32 to 8:35 the pen was deflected off the sheet by the very strong motion, producing a gap in the record which, however, was resumed when the motion subsided a little. The original record sheet is 36 inches long and vibratory motion is perceptible for fully four hours. The complete period of the larger waves was from 20 to 30 seconds. Such vibrations are very slow and appear to be entirely imperceptible to human beings, nor do they affect buildings or other structures injuriously, so far as can be ascertained. C. F. MARVIN.

Chief of the United States Weather Bureau.

EARTHS, a term applied by alchemists to substances which were considered elementary bodies, but since the researches of Lavoisier and Sir Humphry Davy, defined as metallic oxides or compounds of oxygen with metals similar to potassium and sodium. Earths are seldom found in a state of natural purity, but constitute chiefly the component parts of gravel, soil or strata. The more important earths are divided into two classes; alkaline earths, lime, baryta, strontia and magnesia; and proper earths, alumina, zircoma, glucina, yttria and thorina; most of these are treated under separate titles, to which refer. The alkaline earths resemble the alkalis. They are soluble in water; baryta and strontia readily, lime sparingly, and magnesia very slightly. Their solutions affect vegetable colors similarly to the alkalis. They combine with acids, forming neutral salts, some of which are readily soluble in water and others insoluble. The proper earths are insoluble and infusible, and by exposure to heat lose the property of easy solubility in acids.

EARTHWORKS, in military parlance, are permanent or temporary defenses chiefly of earth forming a shield against the enemy's fire. For the various forms of military earthworks see FORTIFICATIONS.

EARTHWORM, any terrestrial annelid of the order *Oligochæta*. Although certain families of *Oligochæta* are strictly aquatic and others exclusively terrestrial, still others contain both aquatic and terrestrial species, and aside from peculiarities which are obviously adaptations to the mode of life no sharp distinctions can be drawn between these two classes. The earthworms generally are larger and more robust, with shorter setæ than the waterworms and have dorsal pores. Within recent years the earthworms have attracted much attention from systematic writers and no less than 800 species, of which upward of 90 inhabit North America, are now known. Externally they look much alike, but in their internal anatomy exhibit an astonishing variety. The common earthworms of Europe and America, of which a dozen or more species may be found in almost any suitable locality, belong chiefly to the genera *Lumbricus* and *Allolobophora* which have the setæ arranged in four pairs on each somite, a well-developed girdle or clitellum occupying a variable number of segments toward the anterior end, the female and male genital pores on the 14th to 15th segments respectively and various complex internal peculiarities of the reproductive organs. While our species rarely equal a foot in length, several South African and Australian species reach five feet. Earthworms inhabit nearly all parts of the earth except the frozen regions of high latitudes and altitudes, dry sandy soils and some portions of the North American prairies. Their habits are everywhere much alike. They burrow in damp earth, which the common kinds penetrate to the depth of about two feet. They swallow the soil and after digesting its nourishing elements reject the rest in the form of castings from the mouths of their burrows. At night they partly leave their burrows and draw to them the petioles of leaves, etc., on which they feed and with which they close the openings in cold weather. In this way they also seek one another's company and copulate, as hermaphrodites mutually fertilizing each other. A cocoon is formed by secretions of the clitellum and receives the eggs and spermatozoa in a quantity of albumen as it slips past the openings of the genital ducts toward the head, from which it passes and remains in the earth. During the winter they burrow to a depth beyond the reach of frost, but some species at least will survive actual freezing. The importance of earthworms as cultivators of the soil can scarcely be overestimated. By their burrowing they render it porous and permeable to the rain and air; they continually turn the earth by bringing up soil from beneath the surface and they add to its fertility by burying vegetable matter and by their secretions. Darwin has estimated that earthworms bring to the surface in rich meadow lands not less than one-fifth inch of soil per annum, and recent laboratory experiments demonstrate most emphatically the beneficial influence on plants of the presence of earthworms.

The body wall of earthworms consists of an epidermis, one layer thick except on the clitellum; a layer of articular muscles; and an inner layer of longitudinal muscles. The chætæ are shaped like a large S. The nervous system consists of a pair of dorsal cerebral ganglia, connected with a ventral ganglionated cord. Special sense-organs are absent, except for tactile cells, but touch, sensitivity to light and color-sense exists. There is a definite body-cavity, split up into separate compartments for each segment. It communicates with the outside through dorsal pores. The vascular system is closed and consists primarily of a dorsal contractile vessel and ventral noncontractile one, communicating by transverse contractile trunks in front and capillaries behind. The excretory system consists of variously modified nephridia opening into the cœlum and to the outside. The digestive tube is usually straight and consists of a ventral mouth, a buccal cavity, a muscular pharynx, an œsophagus and an intestine opening by a terminal anus. Various glandular appendages exist and the whole system is often complicated in several respects. The reproductive glands lie in the wall of the cœlum; their complicated ducts are probably modified nephridia.

Consult Beddard, 'Earthworms and their Allies' (New York 1912); Darwin, 'Formation of Vegetable Mould' (London 1881).

EARWIG, an orthopterous insect, forming type of a family, *Forficulidæ*. This insect has generally a habit of concealing itself in cavities, endeavoring to reach their innermost recesses and in some rare cases may have sought a hiding place in the ear, but its passage into the internal ear would be stopped either by the waxy secretions or by the tympanic membrane. In any case, there is not much basis for the legend that it is in the habit of creeping into the ears of sleepers. The common earwig (*F. auricularia*) is found throughout Europe, in North Africa, Asia Minor and North America. It has a length of from two-fifths to two-thirds of an inch; the antennæ are thread-like, and the number of joints is 15. The fore wings are short, horny and somewhat rectangular, but the larger hind wings are thin and mainly membranous and fold up somewhat like a fan under the fore wings. The last segment of the abdomen carries a pair of curved, horny, pincher-like appendages, which in the male are toothed at the base. The eggs are laid in spring, about 20 at a time, and are carefully protected by the female. The young earwigs differ little except in size from the mature insects; they are guarded by the mother during the first period of their existence. Earwigs shun light as far as possible and this habit is taken advantage of by gardeners to catch them and destroy them. However, their partly predatory habits benefit the gardener by destroying more obnoxious insects. In the daytime they may be found in various situations, such as beneath the bark of trees, under stones, in the soil, or in any suitable hole. They feed on fruits, seeds, leaves and flowers, and at times on animal refuse. Eight other species of this genus are found in Europe. In the genus *Chelidura*, represented in Europe by nine species, the wings are altogether wanting. *Labia* is another genus with only one European species (*L. minor*), which is common in Great Britain about manure heaps and similar habitats. See ORTHOPTERA.

EASEMENT, a legal term, denoting a privilege comprising a permanent public or personal right as legal owner of one parcel of land, to use, or forbid its use, for some special purpose, with regard to a parcel of land belonging to another owner. This definition includes easements strictly so called, which are always appurtenant to land, public easements and easements in gross or such as are attached to the person. In more general terms it is said that the right of making use of the land of others, whether it be that of the public or individuals, for a precise and definite purpose, not inconsistent with a general right of property in the owner, especially where it is for the public use, is in legal contemplation an easement or franchise, and not a grant of the soil or general property. In the civil law the land against which the privilege exists is called the servient tenement; its proprietor the servient owner; he in whose favor it exists the dominant owner; his land the dominant tenement. And, as these rights are not personal and do not change with the persons who may own the respective estates, it is very common to personify the estates as themselves owning or enjoying the easements. Easements have these essential qualities. There must be two tenements owned by several proprietors: the dominant, to which the privilege is attached; the servient, upon which it is imposed. Considered strictly, easements exist only in favor of, and are imposed only on, corporeal property. They confer no right to any profits arising from the servient tenement. They are incorporeal. At common law they may be temporary; by the civil law the cause must be perpetual. They impose no duty on the servient owner, except not to change his tenement to the prejudice or destruction of the privilege. Easements are of various kinds. They are as various as the exigencies of domestic convenience or the purposes to which buildings or land may be applied. The following attach to land as incidents or appurtenances, to wit: The right of pasture on other land; of taking game on other land; of fishing in other waters; of taking wood, minerals or other produce of the soil from other land; of receiving air, light, or heat from or over other land; of receiving or discharging water over, or having support to buildings from other land; of going on other lands to clear a mill stream, or repair its banks or draw water from a spring there, or to do some other act involving ownership; of carrying on an offensive trade; of burying in a church or a particular vault, etc. Some of these are affirmative or positive, that is, authorizing the commission of acts on the lands of another actually injurious to it, as a right of way — or negative, being only consequentially injurious, as forbidding the owner from building to the obstruction of light of the dominant tenement. Easements of every kind must originate in a grant or agreement, express or implied, of the owner of the servient tenement. By the common law, the evidence of their existence may be by proof of the agreement itself, or by prescription, requiring actual and uninterrupted enjoyment immemorially, or for upward of 20 years, to the extent of the easement claimed from which a grant is implied. Easements of the negative kind do not admit of possession and by the civil law they cannot be acquired by prescription and can only be proved by grant. Use is not essential, therefore, to their existence. Easements may be extinguished by release; by merger, when the dominant and servient tenements are united under the same title and to the same person; by necessity, as by a license to the servient owner to do some act incompatible with its existence; by cessation of enjoyment, when acquired by prescription — the non-user being evidence of a release where the abandonment has continued at least as long as the user from which the right arose. A shorter time will answer in some cases. Interference with a right of easement is an action of trespass, or of case, where the offense is one of consequential damages. Redress may be gained through a court of equity for the infringement of easement.

Consult Holland, 'The Elements of Jurisprudence' (9th ed., New York 1900); Goddard, 'Easements' (4th ed., London 1900); Jones, 'Treatise on the Law of Easements' (Boston 1898); Innes, 'Easements' (London 1893); Washburn, 'Easements' (4th ed., Boston 1885); Gale, Easements' (7th ed., London 1899).

EAST, Sir Alfred, English artist: b. Kettering, Northamptonshire, 15 Dec. 1849; d. 28 Sept. 1913. He studied in Paris at the École des Beaux Arts and under Julian and Bouguereau. He was knighted in 1910 and was elected a Royal Academician 1913. He has exhibited at the Royal Academy for many years and among his works are 'A Passing Storm,' 'A Haunt of Ancient Peace,' 'The Nene Valley,' 'An Idyl of Spring;' 'London at Night'; 'The Morning Moon'; 'Autumn in the Valley of the Seine.'

EAST AFRICA, British. See East Africa Protectorate.

EAST AFRICA, German, the German possessions in east Africa, acquired in 1885–90, lying immediately to the south of British East Africa, and having an estimated area of about 384,000 square miles and population (1913) of 7,678,132, of whom 5,536 are Europeans. They are bounded on the north by a line running northwest from the Umba River to the eastern shore of the Victoria Nyanza and continuing west from this lake to the Congo State. Lake Tanganyika forms the western boundary and thence a line to Lake Nyassa and the river Rovuma form the southwestern and southern boundaries. In September 1894 it was agreed that the German-Portuguese frontier should follow parallel lat. 10° 40′ S. from the coast to its intersection with the river Rovuma, leaving Kionga and the mouth of the Rovuma to Germany and Cape Delgado to Portugal. Several stations have been established by the German East Africa Company. Two railway lines — the Usambara (223 miles) completed in 1912; and the central railway (780 miles) from Das-el-Salaam, the seat of government, to Ujiji on Lake Tanganyika, completed in February 1914 — are the main arteries of communication. The revenue for 1914 was £825,500 and expenditure £1,188,500. In 1912, 1,034 vessels of a total of 1,913,743 tons entered the various ports. The products of the country are coffee, tobacco, cotton, ivory, caoutchouc and gum. The highest mountain is Kilimanjaro, reaching 19,600 feet. Among the chief rivers are the Rovuma, Rufiji, Kingani and Pangani, flowing to the Indian Ocean; the Kagera, Shimiyu and Ruwara flowing into Victoria Nyanza; and the Malagarazi flowing into Tanganyika. In the north there are several small lakes and in the southwest the larger salt lake, Rukwa or Hikwa. On the coast the chief towns are Mikindani, Lindi, Dar-es-Salaam, Bagamoyo, Pangani, Wanga, and the English mission station Saadani. Inland there are Mpwapwa, Kanyenye, Tabora (Kazeh), Urambo and Ujiji. The country is under an imperial governor. After the outbreak of the great European War the colony was attacked by the Entente Powers, the chief forces being the British and South African troops led by General Smuts, who attacked from the north, while Belgian and Portuguese troops attacked from the south and east. Its conquest was completed on 3 Dec. 1917. For details see War, European.

EAST AFRICA, Portuguese, or MOZAMBIQUE. The possessions of Portugal, comprising three distinct entities: the province of Mozambique (293,580 square miles) the Companhia do Moçambique (59,840 square miles); and the Companhia do Nyāssa (73,292 square miles). The first-named is divided into five districts, with Lourenço Marques as the capital. Its coast line extends south from Cape Delgado, the southern extremity of the coast-line of German East Africa to Kosi Bay, just below Delagoa Bay, at a point separating British from Portuguese territory, as fixed by the Anglo-Portuguese agreement of 1891; the northern boundary is the river Rovuma, running west from Cape Delgado to Lake Nyassa. The frontier between German and Portuguese East Africa runs along parallel lat. 10° 40′ S. from the coast to its intersection with the river Rovuma, leaving the mouth of the Rovuma and Kionga to Germany and Cape Delgado to Portugal. The eastern boundary is the lake and British Central Africa, or the Nyassa Protectorate down to the junction of the Shiré with the Zambesi; while from that point Rhodesia, including Mashonaland and Matabeleland and the Transvaal form the boundary. Its total area is 426,712 square miles, and the population is estimated to be between three and four millions. The principal exports are sugar, oilnuts and seeds, caoutchouc, ivory and mining products. The Mozambique Company administers Sofala and Manica, the Nyassa Company has jurisdiction in the northern part between Lake Nyassa, the Rovuma and the Lurio, Bulawayo. The railway from Delagoa Bay (57 miles in colony) connects with Pretoria; and that from Beira (204 miles in colony) with Bulawayo; and there are three smaller lines. There were in 1912 2,959 miles of telegraphs. The coast-lands are low-lying and not very healthy, but in the region of the Namuli Mountains there is one of the finest and most beautiful tracts of country in the whole continent. There are several important rivers, including the Zambesi, Limpopo, Rovuma, Sabi, Pungwe, Lurio, Mtepwesi, Lukuga and many others. The most important towns are Lourenço Marques (pop. 9,849; 4,691 Europeans), Mozambique, Ibo, Zumbo, Tetet and Sena. Gold is found in the Manica region on the west and has been worked by British capitalists.

EAST AFRICA PROTECTORATE, a British dependency, extending from the Umba to the Juba River, and as far inland as Uganda. It includes certain lands rented at an annual fee of £17,000 from the Sultan of Zanzibar; namely, the Lamu Archipelago; a strip 10 miles inland reaching from the German frontier to Kipini; and the area for 10 miles around the fort of Kismayu. The rest of the country is divided into seven provinces, and an extraneous unorganized piece of land in the north, as follows: Seyidie, Ukamba, Tanaland, Jubaland, Kenya, Naivasha and Nyanza. The area is estimated at 250,000 square miles; the population at 4,038,000. The various nationalities which go to make up the Protectorate are distributed as follows: Arabs and Swahilis along the coast; Bantu tribes further inland, and still further, non-Bantu tribes. The Asiatics number some 25,000, and the Europeans and Eurasians 5,000.

Agriculture is extensively carried on, the products grown being rice, maize, grains, casava, cocoanuts, sisal hemp, Ceara rubber, cotton, etc.,

in the lowlands; and on the highlands, oats, barley, wheat, potatoes and various products of truck farming. Coffee growing is a rapidly increasing industry. In the uplands cattle grazing is becoming most important. Sheep, cattle and ostriches are profitably farmed. There is also some dairying. There are more than 3,000 miles of forest land, a deep tropical forest occupying about 180 square miles of the lowlands. Ebony, copal and rubber trees are found near the coast, while the upland countries yield valuable cedars, yellow woods, camphor, jarrah, cork, iron-wood, pillar-wood and olive. The entire timber resources are not yet completely explored. The mineral resources likewise have not been fully developed. In the Rift Valley, near German East Africa, generous deposits of natron and diatomite have been found. A little gold has been mined in South Kavirondo; graphite, marble, limestone and manganese have been produced in appreciable quantities, and some fine opals have occasionally been unearthed in the Rift Valley. The chief imports are clothing, provisions, building materials, iron and steel products and leather goods. In 1916–17, the imports amounted to £3,024,123; the exports £1,613,853, and the tonnage entered and cleared, to 1,441,877 tons. The State Railway is called the Mombasa-Victoria or Uganda Railway, and is 618 miles. There are competent telegraph, telephone and postal services.

The government of the Protectorate is under a governor and commander-in-chief under the Colonial Office. An executive and legislative council are also provided. The principal cities are Nairobi, where the administrative headquarters are located; Mombasa, the chief port (pop. about 30,000; 230 Europeans); Kilindini, a splendid harbor on the east coast; Jubaland, Kenya, Nawasha and Kiseemu. The expenditure of the government for 1917–18 is estimated at £1,484,075; and the revenue for 1916–17 amounted to £1,533,783, derived from licenses, dues, taxes, court fees, railways, customs, etc. A railroad was built by Col. J. H. Patterson for the government, in 1899, from Mombasa to Nairobi. Consult Lugard, 'British East Africa and Uganda' (London 1892); Eliot, 'East Africa Protectorate' (ib. 1905); the 'Oxford Survey of the British Empire' (Vol. III, London 1914); and the publications of the Colonial Office of Great Britain.

EAST ANGLIA, an ancient kingdom of England, its territory corresponding to what is now Norfolk and Suffolk counties. Redwald was its first historical king (593–615).

EAST AURORA, N. Y., village in Erie County, on the Pennsylvania Railroad, 18 miles southeast of Buffalo. The place is noted as the home of the colony of Roycrofters (q.v.), who produce the principal manufactures of the village: hand made furniture, pottery, de luxe editions of books, etc. Roller mills and agricultural implement works are located here. There are also mineral springs and a covered race track. The village owns its waterworks and sewage plant. It is a residential suburb of Buffalo. Pop. 2,784. See ROYCROFTERS.

EAST BRIDGEWATER, Mass., town in Plymouth County, 25 miles south of Boston, on the New York, New Haven and Hartford Railroad. It contains an iron foundry and a cotton gin. Pop. 3,363.

EAST CAPE, the name of the southeastern extremity of New Guinea, in Goschen Strait, and of the most easterly headlands of Madagascar; also on the North Island of New Zealand; also in Siberia, on Bering Strait, in long. 169° 44′ W., in the eastern extremity of Asia. The latter is a bold, rocky promontory, almost cut off from the mainland by swamps and shallow lakes. On the north side is a village, Uédle, of less than 100 huts, with a population of about 260.

EAST CHICAGO, Ind., city located in Lake County, on the southeasterly shore of Lake Michigan, 19 miles from the central business district of Chicago, but only two miles from the east line of Chicago's city limits. It contains three railway stations, known on the maps as East Chicago proper, or as called locally, "The West Side"; Calumet, one mile east of the old town; and Indiana Harbor, on the lake front.

In 1853 title to the land where the city is now built passed from the United States government to the State of Indiana. The following year State patents were given at the rate of $1.25 per acre. During the year 1888 the city of East Chicago was laid out, the town starting two and one-half miles inland from Lake Michigan, it being the idea that the development toward and at the lake would be rapid when once started, owing to natural advantages. It was incorporated as a town in 1889 and chartered as a city in 1893. The panic of 1893 retarded the progress, so the first 10 years' growth was slow and fraught with difficulties. The population in 1900 was 3,400. In 1901 the development of that part of the city known as Indiana Harbor was commenced. Owing to the unlimited rail and water shipping facilities and other natural advantages this development has been phenomenal and with its growth the older section of the city has kept pace. The city has the following excellent transportation facilities: The Lake Shore and Michigan Southern; Pittsburgh, Fort Wayne and Chicago; Chicago, Indiana and Southern; Baltimore and Ohio; Wabash, Pere Marquette and The Chicago Lake Shore and South Bend trunk lines, all of the above passing through the city; and the Elgin, Joliet and Eastern; Baltimore and Ohio Chicago terminal; and the Indiana Harbor Belt Railway lines encircling Chicago and terminating at this point. In addition to the rail facilities the lake shipping facilities are unsurpassed. A harbor 350 feet wide and 22 feet deep, protected by the most modern breakwaters, forms the entrance to the Indiana Harbor Ship Canal, which has been completed from the lake south to the Calumet River to a width of 200 feet and a depth of 21 feet. In addition thereto, a branch of the canal extends west to Lake George; so there is a total of 10 miles of dockage within the city limits which can be reached by the largest vessels on the lake.

This canal connects with the Calumet River so when the latter is improved it will increase the available deep water dockage to 22 miles, and upon completion will give the city one of the best and most extensive commercial harbors in the country. At no other point on Lake Michigan is it possible for three belt railroads

to come into direct connection with navigation. These three belt railroads cross every trunk line entering Chicago, and inasmuch as Chicago freight rates apply to and from this city, it enjoys the best shipping facilities that can be had at any point. In addition to the shipping facilities and trunk line services mentioned, there are three interurban and street car systems in operation in the city and this affords ample accommodation for local transportation. There are 44 industries in full operation, employing 15,000 men, with an annual pay-roll of over $15,000,000. In addition to the plants now in operation, one $5,000,000 plant has been constructed and approximately $12,000,000 more has been spent in additions and improvements. In 1917 it was estimated that there would be employed 5,000 additional men, with a corresponding increase in pay-roll and population. The manufactured articles consist of iron and steel products taken from the raw material and finished to a complete state, embracing everything of iron and steel manufacture from a small bolt to the largest locomotive; also, fire brick, soap, chemicals, liquid air, conduits, hay and cotton presses, auto trucks and cements. The city has seven banks, eight public schools, five parochial schools, four public parks, 20 churches, three public libraries, 50 miles of paved streets, 70 miles of cement walks, 45 miles of sewerage, 35 acres in parks, 350 ornamental light pools, four newspapers, a fine city hall and one of the largest electric power plants in Indiana. There are 105 daily trains to and from Chicago. Over $4,000,000 is invested in bascule bridges across the canal and the city is directly connected with the immense coal fields of Illinois and Indiana and cheap fuel oil supply. The per cent increase in population during the decade ending in 1910 was 559, the largest per cent increase of any city in the United States.

The city is the hub of the great Calumet district in Indiana, and the centre of a population of 120,000 people. Adjoining on the northeast is beautiful Lake Michigan, on the west the city of Whiting, on the west and south the city of Hammond and on the east the city of Gary, all of these cities being within a radius of five miles from the centre of East Chicago, which thus forms a natural hub for the entire Calumet district. The government is vested in a mayor and a council of six members. Pop. 30,000.

FRANK L. EVANS,
Secretary East Chicago Chamber of Commerce.

EAST GRAND FORKS, Minn., city of Polk County, at the junction of the Red and the Red Lake railways, opposite Grand Forks, N. D., and on the Northern Pacific and the Great Northern railways. It is surrounded by a fertile farming and wheat-raising district. The chief manufactures are lumber and beer. Pop. 2,533.

EAST GREENWICH, R. I., town, county-seat of Kent County, 14 miles south of Providence, on Greenwich Bay and on the New York, New Haven and Hartford Railroad. It is a summer resort and residential town, and has manufactures of cotton and woolen goods, dry salter works, dextrin, soap and chemicals. Greenwich Academy is situated here, and the town has a public library, public water and electric lights. It was the birthplace of Gen. Nathanael Greene. Pop. 3,420.

EAST HAMPTON, N. Y., town in Suffolk County, in the eastern part of Long Island; on the Long Island Railroad, about 102 miles east of New York. The town is picturesquely situated and enjoys some reputation as a summer resort. It contains the Clinton Academy building, erected in 1784, which has been transformed into a town hall and library. After the war with Spain the volunteer troops were mustered out of the Federal service at the camp nearby at Montauk Point. Every two years town meetings are held. The first settlement was made in 1649 and the place was considered as belonging to Connecticut from 1657 to 1664 when it came under the jurisdiction of New York. During the Revolution it was frequently pillaged by the English. It was the home of John Howard Payne (q.v.). Pop. 3,500. Consult Gardner, 'Records of East Hampton' (Sag Harbor 1886-89); Hedges, 'History of the Town of East Hampton' (Sag Harbor 1897).

EAST HARTFORD, Conn., town in Hartford County, on the New York, New Haven and Hartford Railroad, and on the Connecticut River, two miles east of Hartford. The town contains the Raymond library, a town library and a cemetery over 200 years old. It was first settled in 1640 but was not incorporated as a town until 1783. It is the birthplace of William Pitkin, Colonial governor. The form of government is by town meetings. The railroad shops and paper-mills give employment to a number of people. Large quantities of tobacco and garden vegetables are raised on adjacent farms. Pop. 8,875.

EAST HUMBOLDT MOUNTAINS, Nevada, a forested range of mountains principally in Elko County, separating on the east and west, respectively, the Ruby and Huntingdon valleys. Fremont's Pass is in these mountains.

EAST INDIA COMPANIES, the various European trading companies chartered by their respective governments for the control of their trade in India and the adjacent countries and islands. From an early period, the Italian republics had established a flourishing trade with these Eastern dominions, which was interrupted by the Moslem conquest of Egypt and Constantinople and the establishment of Turkish rule in Africa and Europe. Under these circumstances arose that spirit of maritime exploration in the 15th century for the discovery of a new passage to the Indies which resulted in the discovery of America by Columbus while seeking a westward route, and in Vasco da Gama sailing around the Cape of Good Hope and reaching the Malabar coast in 1498. This latter discovery gave a new impulse and direction to commercial enterprise, and in nearly all the leading nations of Europe steps were taken to participate in the advantages prospectively revealed in the opening up of this new ocean highway. The 16th century was marked by the Portuguese establishing themselves in India; by English efforts to discover overland and northern passages to India, which while fruitless in the latter direction gave rise to commercial relations with the northern coast of Russia; by the union of Portugal and Spain in 1580, and in the war with England which closed

the Spanish-Portuguese avenues for Indian produce to that country; and by the revolt of the Netherlands against Spanish dominion which gave a parallel check to the Dutch Indian trade. These two latter events compelled Holland and England to seek direct communication with India; in 1582, a Captain Stephens was the first Englishman to reach India via the Cape of Good Hope, and in 1586 Thomas Cavendish followed by way of Cape Horn. In the following decade the great historical commercial corporations known as the Dutch and the English East India companies were organized, and later were followed by Danish, French and Swedish enterprises.

The Portuguese East India Company was organized in 1587, when, owing to laxity in the official management of the trade developed since 1498, it was entrusted to a company of Portuguese merchants in consideration of an annual payment. The company had a turbulent existence, chiefly of conquest by the Dutch until its dissolution in 1640, since which time the unimportant Portuguese settlements have been under Crown administration.

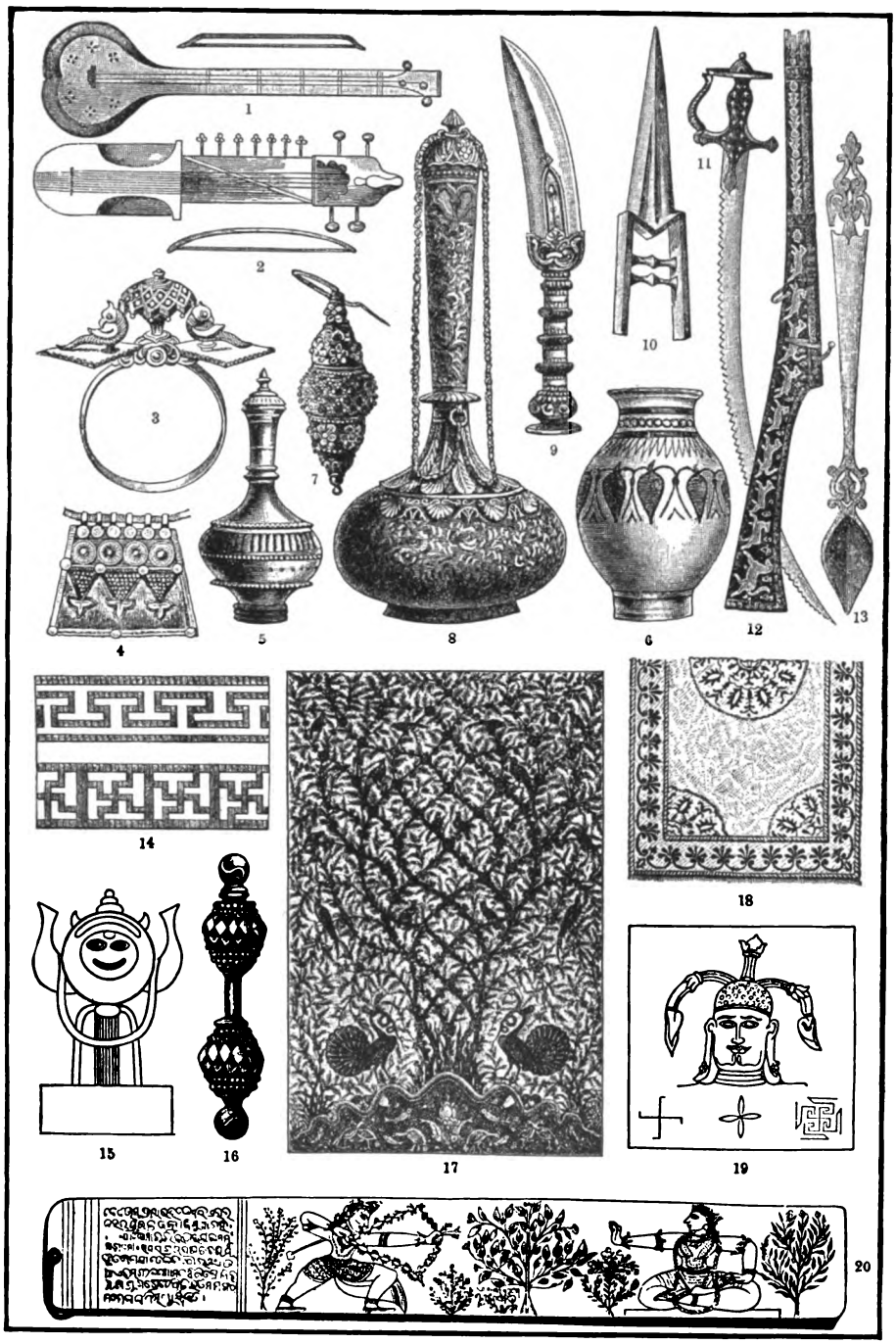
The Dutch East India Company was formed at Amsterdam in 1595 as "a company for remote parts," in 1602 amalgamated with several minor companies and received a charter conferring the exclusive privilege of trade to the East Indies for 21 years, with the necessary civil and military powers. It had a wonderfully prosperous career and its charter was extended to 1644, when French and English competition had made itself so felt that the Dutch company had difficulty in raising the government subsidy for a 21 years' renewal of the charter.

The Peace of Westphalia in 1648, ensuring the independence of Holland, inaugurated a new era of prosperity; the company colonized the Cape of Good Hope between 1650 and 1670; in 1658 captured Ceylon from the Portuguese; the same year took Formosa, from which they were driven three years later by a Chinese adventurer; in 1663 obtained possession of the chief Portuguese settlements along the Malabar coast, and in 1666 monopolized the spice trade by the capture of Macassar. Their charter was renewed periodically until 1776; in 1781, owing to the expenses of the prolonged struggle against English encroachment, the company had to be assisted with a government loan, and in 1795 the proclamation of the Batavian republic terminated its existence; in 1798 the mother-country assumed the administration of the company's former possessions.

The English East India Company formed in 1599 and chartered by Queen Elizabeth in 1600, under the title of the "Governor and Company of Merchants of London trading with the East Indies," was the most important, commercially and historically, of the East India companies. The trading limits assigned by the charter for 15 years were "all the islands, ports, havens, cities, creeks, towns and places of Asia, Africa, and America, or any of them, beyond the Cape of Bona Esperanza to the Straits of Magellan, with the exception of such places as are already in possession of any Christian prince in league or amity with the British Crown who shall refuse his consent to such trade." The company comprised 125 stockholders, including a governor and 24 directors elected annually to supervise the company's business. The early voyages of Lancaster, Beal, Best and others resulted in large profits; in valuable commercial treaties being entered into with native princes; and in English prestige being considerably enhanced throughout the Orient by naval and political successes over the Portuguese. The establishment of factories in various stations, however, excited the jealousy of the Dutch, who in 1624 massacred the members of the English factory at Amboyna, an atrocity for which Cromwell in 1654 compelled the Dutch government to cede an island and to pay a sum of $1,500,000 as compensation to the victims' families. This incident inaugurated the struggle which resulted in the loss to the Dutch of all their possessions on the Indian peninsula. With periodical renewals of its charter, the company, overcoming all rivalry and opposition, maintained its position. From 1745 to 1761 it was engaged in a crucial fight throughout the Carnatic for supremacy with the French company established in 1664, and which under La Bourdonnais and Dupleix had obtained almost paramount power in India; Clive (q.v.) brought it safely through the struggle. It was with reluctance, however, that the company accepted the position which their victories over the French and the native states was forcing upon them of territorial magnates and unconsciously of founders of the British empire in India; especially when their growing political importance inspired the home government with a desire to control their company.

In 1766 the right of the company to acquire territorial possessions formed a subject of inquiry in the British Parliament; and a year later a resolution of the proprietors to raise their dividend to 12½ per cent was vetoed. The question of political rights of the company being thus raised, the British ministry acted on their view of it by sending a Crown plenipotentiary to India, and after a protracted struggle, a regulating act was passed in 1773 remodeling the powers of the company and placing it under the control of Parliament. The constitution of the councils of the presidencies was regulated and their superintendence assigned to a Crown official, Warren Hastings (q.v.) being appointed first governor-general. A further act introduced by Pitt in 1784 modified the political power of the company by establishing a board of control to superintend, direct and control all acts, operations and concerns relating to the civil and military government or revenues of India. From this time the political power of the company was little more than nominal; the right of nominating its officials still remained with the directors, but the absolute right of recall was vested in the Crown. The company's charter was renewed with a few changes in 1793 and subsequently at intervals of 20 years; in 1813 it lost the monopoly of the Indian trade, which under certain restrictions was thrown open to all British subjects; its right of exclusive trade was restricted to China, but in 1833 this monopoly was also abolished. Its charter was renewed for the last time in 1853; the Indian mutiny, 1857–58, discredited the company's administration, and in November 1858 a proclamation at Calcutta announced that Queen Victoria had assumed the government of India. The company continued to receive and distribute the dividends guaranteed by the government

EAST INDIAN MANUFACTURES



1, 2 Muscial Instruments
3 Bangle
4 Pendant of a Necklace
5, 6 Vases of Glazed Pottery
7 Earring
8 Engraved and Gilded Bottle
9 Spearhead
10 Dagger; from Khuttar
11 Saw-edge Sabre
12 Flint Matchlock
13 Wooden Spoon
14 Border of a Mat
15 Symbol of Juggernaut
16 Nose Ornament
17 Printed Cotton
18 Cotton Carpet
19 Emblem of Jain Sect
20 Illuminated Manuscript

until the East India Stock Dividend Redemption Act became operative in 1874 when the company was dissolved.

The Danish East India Company, founded in 1618, dissolved in 1634, reconstituted in 1670, again dissolved in 1729, was succeeded in 1732 by the Danish Asiatic Company. This company had a prosperous career until the war between Great Britain and Denmark in 1801, when its trade declined and ended with the cession of Tranquebar and Serampore to Great Britain in 1845.

The French East India Company, known as "La Compagnie des Indes Orientales," was founded in 1664 by Colbert, Minister to Louis XIV. It had extensive privileges, and in 1675 made a settlement at Surat, and in the following year at Pondicherry. It had a long and prosperous career, notwithstanding the loss of trading privileges at various periods and its connections with the Mississippi Bubble (q.v.). It reached the height of its prosperity under Dupleix (q.v.) and La Bourdonnais, extending its operations until the Deccan and the Carnatic were practically under French control, when antagonism with the English under Clive, the recall of Duplex, and practical abandonment by the French government, led to the dissolution of the company by royal decree in 1769.

The Swedish East India Company, founded at Gothenburg in 1741, was reorganized in 1806.

Bibliography.— 'Charters granted to East-India Company from 1601'; Macpherson, 'History and Management of East India Company' (1779); Bruce, 'Annals of the East India Company' (1810); Stevens, 'Dawn of British Trade to the East Indies' (1886); Foster, 'Letters received by East India Company from its servants in the East' (6 vols., 1902); Castonnet des Fosses, 'L'Inde Française avant Dupleix' (1887).

EAST INDIES, or MALAY ARCHIPELAGO, the double chain of islands which extends from the southeastern corner of Asia to the northern extremity of Australia. On the Pacific side there are the islands of Borneo, Celebes, Buton, Sula Island, Buru, Morotai, Jilolo or Halmahera, Amboyna, Ceram, Banda, Waigeu, Misol, Salwati and New Guinea. The Sulu Archipelago and the Philippines are a northward extension of this chain, the connecting links being Sangir and Talaut groups of islands. Next the Indian Ocean the southern chain includes Sumatra, Singapore Island Riouw-Lingga, Banca, Billiton, Java, Madura, Bali, Lombok, Sumbawa, Sandalwood, Flores, Timor and the Tenimber, Kei and Aru groups. All these belong to the Netherlands, except the Philippines and Sulu Islands (property of the United States), the northern part of Borneo (British), the eastern half of Timor (Portuguese), the eastern portions of New Guinea (British), and Singapore Island (British). Several of the islands (e.g., Java, Sumatra) are studded with active volcanoes. The entire archipelago seems to represent the surviving fragments of an ancient land connection between Asia and Australia, the evidence in support of this view being especially strong in Borneo and Celebes. The inhabitants are mostly of the Malay race; though Chinese, Arabs, indigenous tribes and various Europeans are also present. As these islands lie on each side of the equator, their climate is equably hot; and it is also moist, for they fall within the influence of the monsoons. Consult Angier, A. G., 'The Far East Revisited,' with a preface by Sir Robert Hart (London 1908); Day, C., 'The Policy and Administration of the Dutch in Java' (New York 1904); Gomes, E. H., 'Seventeen Years Among the Sea Dyaks of Borneo' (London 1911); Swettenham, F., 'British Malaya' (London 1907); Taunton, H., 'Australind: Wanderings in Western Australia and the Malay East' (London 1903); Robson, J. H. M., 'Motoring in Malaya' (London 1911); Wallace, A. R., 'On the Physical Geography of the Malay Archipelago' (*Royal Geographical Soc. Jour.*, London 1863, v. 33) and 'The Malay Archipelago' (London 1869 and 10th ed., London 1906).

EAST INDIES, Dutch. See DUTCH EAST INDIES.

EAST LIVERPOOL, Ohio, city in Columbiana County, on the Ohio River, and on the Pennsylvania Railroad, 45 miles west of Pittsburgh. It has freight packet connections with all important Ohio River ports, extensive china, porcelain, earthenware, terra cotta and glass works, foundries and machine shops. East Liverpool is the most important centre in the United States for the manufacture of porcelain, including porcelain dinner ware, floor tile and porcelain electrical supplies. The United States census of manufactures for 1914 showed within the city limits 89 industrial establishments of factory grade, employing 5,180 persons, 4,830 being wage earners, receiving annually $2,935,000 in wages. The capital invested aggregated $6,593,000, and the year's output was valued at $7,093,000; of this $4,251,000 was the value added by manufacture. It has the largest pottery works in the United States, natural gas furnishes light and fuel, and the waterworks are owned by the city. It has a Carnegie library and three parks. Two bridges connect the city with Chester and Newell, W. Va. It has good schools, one business college, three national banks and daily and weekly newspapers. Under the Ohio Code of 1902, the government is vested in a mayor and a board of public service, elected for two years, and a council. The board of public safety is appointed by the executive and council. East Liverpool was settled in 1795 and was incorporated in 1834. Pop. 21,877.

EAST LYNNE, a novel by Mrs. Henry Wood, which appeared in 1861. It takes its name from the ancestral home of the heroine, Lady Isabel Vane. Several years after marriage, mistakenly doubting her husband's fidelity, she leaves him for another, but later returns in disguise as nurse to her own children, and on her deathbed receives his forgiveness. Although 'East Lynne' has little literary merit, it secured immediate popularity, has been through many editions on two continents, and proved extremely successful as an emotional drama.

EAST MAIN, Canada, region of the Dominion which formerly belonged to the Hudson Bay Territory, but which is now in the Ungava District, province of Quebec. It is a bleak and desolate country, yielding little to commerce but fish oil and a few furs. The East Main or Slade River crosses its southern section, entering James Bay, the southern extension of Hudson Bay, about lat. 52° 15″ N. The river has a length of about 400 miles.

EAST ORANGE, N. J., city in Essex County, on the main line of the Lackawanna Railroad, and on a branch of the Erie Railroad, about 12 miles west of New York. It is a residential city, its population being made up largely of people who do business in New York and Newark. The city contains many handsome churches and private residences, a public library, municipal playgrounds, an orphan asylum, a woman's club, high and graded schools, a national bank and weekly newspaper. Its industrial plants include electrical works and manufactories of pharmaceutical supplies, brass and iron casting and bread. The United States census of manufactures for 1914 showed within the city limits 51 industrial establishments of factory grade, employing 2,610 persons, 1,949 being wage earners, receiving annually a total of $1,130,000 in wages. The capital invested aggregated $6,618,000, and the year's output was valued at $5,407,000; of this $3,018,000 was the value added by manufacture. The government is administered by a mayor, elected biennially, and a city council. All municipal officials are appointed by the executive with the consent of the council. The waterworks are owned by the city. East Orange was part of Orange until 1863, when it was incorporated as a separate township. In 1899 it was chartered as a city. Pop. 39,852. Consult Whittemore, 'The Founders and the Builders of the Oranges' (Newark 1896).

EAST PROVIDENCE, R. I., town in Providence County, on the Seekonk River, and on the New York, New Haven and Hartford Railroad. It lies directly opposite the city of Providence. East Providence and the town of Seekonk, Mass., were once a part of the old town of Rehoboth. It was set off from Seekonk when the Massachusetts-Rhode Island boundary line was fixed and was incorporated in 1862. The town has extensive chemical works, electrical and wire works, bleacheries, linen manufactures and other industries. The government is administered by a town council, which elects a majority of the local officials. The council members are elected annually by popular vote. Pop. 17,369.

EAST RIVER, the strait connecting Long Island Sound and upper New York Bay. The East River receives the waters of the Harlem River, which is connected with the Hudson by the Harlem Ship Canal, thus making a complete waterway around Manhattan borough, which the East River separates from Brooklyn and Queens boroughs on the Long Island shore. The designation covers a length of about 16 miles having a width of from 1,000 yards to three miles. Blackwell's, Randall's, Ward's, Rikers, and North Brother islands are on the East River. Between Ward's Island and Long Island there are rapids known as Hell Gate; long a danger to mariners they have been rendered safe for the largest vessels by blasting the sunken reefs. The River is spanned by the Williamsburg, Queensboro, Manhattan, the old Brooklyn, and the new Hell Gate bridges.

EAST SAGINAW, Mich. See SAGINAW.

EAST SAINT LOUIS, Ill., city of Saint Clair County, located on the left bank of the Mississippi, opposite Saint Louis, Mo., with which it is connected by several bridges.

Communications, etc.— East Saint Louis is served by 27 trunk line railroads, all connected by four terminal belt lines. One hundred and twenty-five passenger trains and 150 freight trains are at the daily service of East Saint Louis. The total mileage of all railroads entering the city is 64,000. The list of steam railroads is as follows: Rock Island; Chicago, Peoria and Saint Louis; Burlington; Chicago and Eastern Illinois; Chicago and Alton; Wabash; Illinois Central; Big Four; Toledo, Saint Louis and Western; Cotton Belt; Saint Louis, Troy and Eastern; Litchfield and Madison; Pennsylvania; Baltimore and Ohio; Saint Louis and O'Fallon; Southern; Louisville and Nashville; Mobile and Ohio; Iron Mountain; Frisco; and Missouri Pacific.

In addition to the steam roads there are also the Illinois Traction Company, known as the McKinley System, the East Saint Louis, Columbia and Waterloo Railway, and the Alton, Granite and Saint Louis Traction Company, Saint Louis and Belleville Electric Railway, and Southern Traction Company, all electric roads. These roads tap the large and prolific agricultural district around East Saint Louis. There are 75 miles of paved streets and 35 miles of electric street railways.

Public Buildings, Educational Facilities, etc.— The noteworthy public buildings are the city hall, high school and public library. The city maintains 38 primary and secondary schools, two business colleges, and there are 40 churches of various denominations and four theatres. There are four amusement parks and eight public parks, including Jones Park, with an area of 47 acres.

Commerce and Industry.—East Saint Louis is an important manufacturing centre, manufacturing everything from nails to locomotives. Its industrial interests are aided by the valuable bituminous coal deposits of Illinois, 10,000,000 tons of which are mined annually in the vicinity of East Saint Louis. The city has manufactories of baking powder, oxide of alumina, roofing paper, malleable iron, glass, railroad frogs and switches, white lead, paint, car trucks, bridges, vehicle springs, forgings, pneumatic tools and silica, and there are several grain elevators, flour mills, foundries, a rolling mill and fertilizer plant. It is the largest alfalfa stock feed producing centre in the United States, and there are also stock yards, a horse and mule market, the largest in the world, and pork and dressed beef packing industries. The live stock receipts of the National stock yards of East Saint Louis during 1912 filled over 84,000 cars. The live stock sales during 1915 exceeded $150,000,000. In 1915 the report shows that the National stock yards received 991,709 cattle, 2,591,768 hogs, 642,141 sheep, 270,612 horses and mules. Over 5,000 men are employed in and around the National stock yards. The freight charges paid on live stock received at the yards exceed $4,000,000 per annum. The yards maintain a railroad of 36 miles, operating 14 first-class locomotives. East Saint Louis has 25,000 industrial workers. The annual payroll of the city manufacturers is $20,000,000. Thirty million tons of freight are handled every year. Its factories consume 3,000,000 tons of coal every year. The mortality rate of East

Saint Louis is 11.58, lower than the mortality rate of the United States, which is 15.00. It has six banks with combined resources of $15,000,000.

History, Public Improvements, etc.— The city was incorporated as a town in 1861 and received its city charter four years later. It is a progressive municipality, having expended upwards of $65,000,000 in street and other improvements, principally for flood protection and drainage. The flood protection includes a river front levee along the Mississippi, 31 miles in length and seven feet higher than the flood record of 1903. The Cahokia Creek, which formerly passed through East Saint Louis, is being converted into a drainage sewer, most of its headwaters having been diverted to the Mississippi River through a channel four and one-half miles long and 18 miles north of the city. A three-mile limestone wharf is being constructed along the Mississippi River in front of the city. Water, gas and electric power are supplied by private corporations. Hydro-electric power from the Keokuk Dam plant is available at very low rates. A fine quality of well water for manufacturing purposes can be obtained anywhere at a depth of 100 feet.

Government, Population, etc.— The government is vested in a mayor, elected for two years, and a city council, of which the mayor is a member ex-officio. The people elect the city treasurer, city attorney, justices of peace, tax assessors, city clerk and City Court judges. The city has adopted the Commission form of government which becomes operative April 1919. The growth of the city has been very rapid. East Saint Louis had a population of 5,664 in 1870; 58,547 in 1910; and 92,983 in 1917.

D. WALTER POTTS,
Superintendent of Schools.

EASTBOURNE, England, county, borough and bathing place in Sussex, near Beachy Head, and between Brighton and Hastings. It contains a fine park of 13 acres and several other smaller recreation grounds. A fine esplanade skirts the shore for over two miles. In 1886 the town hall was erected. The town was incorporated in 1883 and became a county borough in 1911. The electric-lighting plant, omnibus lines, technical institute and hospital are the property of the borough. Its excellent water supply and sewage system and its healthful situation combine to make it one of the most popular resorts on the famed south coast. Pop. 52,544.

EASTCHEAP, London, England, formerly a large market in the east of the city occupying what is now Billingsgate and Leadenhall market. Several streets or roads converged at the great square, then called Eastcheap. Two of those highways were the old Roman roads which extended northeast and northwest out of the city. Some of the old taverns, notably "Boar's Head," mentioned by Shakespeare and other English authors, were at Eastcheap. At the north end of London Bridge there is now a small street called Eastcheap.

EASTER, the Christian spring festival commemorating the Resurrection. The term in Teutonic and Anglo-Saxon languages is derived from *Ostara,* the divinity of spring of the ancient Norsemen, who was welcomed in a festival of celebration on her annual return, reclothing the earth with greenery and flowers, after each winter and night of death had stripped the world of its faded robes and hidden them away, the sun even in the northernmost inhabited regions disappearing during the coldest winter months. In the Greek and Latin and in the languages derived from them, the spring festival is called *Pascha, Pasch, Pasqua, Pascua, Pâques,* etc., from the Chaldee word *Pascha,* signifying *passing,* the equivalent of the Hebrew *Pesach,* that name recalling the "passing over" of the Hebrew households, when Death smote the firstborn of the Egyptians, as recorded in Exodus xii. To the Norsemen the festival of the divinity of spring which they called *Ostara* or *Eastre* (whence *Easter*) was especially the season of new birth. From this festival arose the symbols of the Easter egg and of the Easter rabbit, as prolific reproducers of species; the decoration of springs and wells with flowers in token of the returning flow of water as a life-giving necessity; and the custom of baptismal cleanliness, purification and regeneration. Every rite has a physical basis. The coloring of the Easter eggs, red, blue, yellow, etc., was borrowed from the rays of the Aurora borealis — the northern lights — and the dawning hues of the Easter sun. At Easter the hearth fire was lighted afresh. Easter bonfires were kindled on the hills, dispersing the germs of evil so far as an Easter fire shed its light. Around these purifying fires young men and maidens who desired marriage during the coming year sang and danced three (or nine) times or gave three leaps over the flame. The foundation of drama is found in these early myths and attendant songs, for example, the desire to express the two great emotions attributed to Nature, her sorrow when the sun is withdrawn and her joy when the fruitful season of growth begins again, is poetically developed with repetition in the Greek dramatic myth of Demeter and Persephone — Latinized as Ceres and Proserpine. While gathering flowers on the plains of Enna in Sicily, Persephone was abducted by "gloomy Dio" — Pluto, the god of the dead — and reigned in Hades as his wife, the majestic queen of the underworld. Her mother, Demeter or Ceres, seeking her, hurries over the earth with a torch in her hand and at last gains the concession from the gods of Persephone's return for a third part of every year. In later years, with the development of agriculture, the festival came to be overshadowed by the rejoicing of the harvest season and by the autumn celebration of the cereal mysteries of the earth-goddess. In the beginning she was not separated from the divinity of spring, who, having wandered for nine months, at last returns, bringing new life and warmth and sunshine to the waiting earth. Therefore at "Eleusis," a general term for a "place of coming or assembly," and not originally a name attached to a special locality, the Greeks celebrated their festivals with the mysterious processions of veiled figures with torches moving from side to side in mimic search for the lost Persephone. The modern Maypole dances have their origin in these same Eleusinian spring celebrations, for the rhythmic interlacing circles of figures holding the brightly colored ribbons recall inevitably the measured

torch-light dance of Eleusis, the search from side to side for lost Persephone. The resemblance between spring festivals throughout the history of the world discloses the universal inclination to worship and reverence, to natural piety. Following the Mosaic injunction of "rites of remembrance" to keep alive the origins of faith, in Catholic countries and communities the Easter hearth fire is commemorated by candles carried to be lit and blessed at the altar, the flame being guarded so that the lowly home fire may be rekindled on Easter morning. Where once the image of Demeter-Ceres in pre-Christian days was borne, that of the Virgin in the Middle Ages was, and in some localities still is, carried about to bless the fields for a fruitful yield. On Rogation Days — days of prayer — between Easter and Ascension, headed by the priest, choirs and congregations of churches also make solemn procession with chanting and garlands to nearby springs and fountains, usually bearing the name of some saint, and celebrate the ancient ceremony of decorating with fresh flowers the springs and wells in token of grateful thanksgiving for the returning flow of the life-giving waters.

Besides being commemorative of the Resurrection of Christ from the dead, the Easter festival of modern times is a memorial of the Christian passover from the Old Dispensation of the moral law to the New Dispensation, wrought by the sacrifice for unity or atonement in the innocent death of Jesus Christ upon the cross. At first the Christian passover was celebrated on the same day as the Hebrew, the 14th day of the month Nisan (April). But the Church at Rome and other churches of the Latin world soon transferred the observance to the Sunday next after the 14th Nisan, primarily to mark the difference between Judaism and Christianity. The churches of Asia and some in the West which were founded by missionaries from the East were slow to adopt the usage of Rome and the diversity of usage gave rise to great controversy; the Westerns deprecating subservience to Judaic custom and the Easterns accusing the Westerns of innovation and departure from the ways of Jesus Christ and his apostles. It was not till the year 325 that a general law of the Church was enacted at the famous Council of Nice prescribing for the universal Church a day for this solemnity. To the bishops of Alexandria was committed in permanence the task of computing for all the churches the time of Easter, that city being the metropolis of science in those times. (See CHRISTIAN DOCTRINE, DEVELOPMENT OF; CANON LAW). But the Alexandrine paschal cycles fixing the date of Easter for a long course of years were unsatisfactory, being both obscure and incorrect and hence were not accepted generally. As a result, in 444, Rome observed 26 March as Easter Day, while Alexandria observed 23 April; and earlier in 387 Easter Day in France was 21 March, in Italy 18 April, in Egypt 25 April. The churches in Great Britain and Ireland were, like those of France and Egypt, at variance with the Mother Church of Rome and from that circumstance has been inferred an Oriental origin of the Gaelic, Scotic and pre-Saxon British churches; whereas in fact, those churches were but adhering to an antiquated rule which they had received from Rome, but which Rome herself had abandoned, having reformed her calendar. In 669, Theodore, archbishop of Canterbury, established the reformed Roman calendar in England. The movable feasts of the Catholic, the Lutheran, Anglican and Protestant Episcopal churches are determined by the day of the month upon which Easter Day falls. (See CALENDAR). Easter Day is now determined as the first Sunday after the paschal full moon, that is the 14th day of the calendar moon, or the full moon which matures upon or near after the 21st of March. If the full moon matures upon a Sunday, Easter Day is the first Sunday following.

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EASTER ISLAND, WAIHU or RAPANUI, the easternmost inhabited of the Polynesian group of islands in the South Pacific Ocean, long. 109° 17′ W.; lat. 27° 6′ S., 1,400 miles east of its nearest neighbor, Pitcairn Island, and 2,000 miles east of Chile, to which it was annexed in 1888 and since made a penal settlement. Its area, triangular in shape, is 42 square miles and contains craters of three extinct volcanoes, one nearly 2,000 feet high. At one time wooded, decayed tree trunks of considerable size are still found, but only a few bush plants now thrive from 10 to 12 feet high. The soil is fertile and different kinds of tropical fruits are grown, including sweet potatoes, bananas and sugar cane. A fair number of cattle, sheep, goats and fowl are reared by the natives who number about 150. The climate with one wet and one dry season is healthful; the water supply consists of some brackish springs and pools inside the volcanic craters. As the "Unsolved mystery of the Pacific," the importance of the island is archæological. In its confined area no less than 550 statues, some of them of colossal size, cut out of gray trachitic lava are found; as well as cyclopean platforms of masonry 30 feet high, and from 200 to 300 feet long; stone houses over 100 feet long with walls 6 feet thick built like forts, and tablets curiously inscribed with hieroglyphics. Of the statues, 40 are standing inside the crater of one of the volcanoes, as many more outside, at the foot of the slope, where they were placed ready for removal to the different platforms. These statues represent various stages of formation, some finished, others nearly completed, and others just commenced. In size they range from three and four feet to nearly 80 feet in length. The largest found in an unfinished state measures 70 feet in length, smallest three feet. What race of men carved these statues and for what purpose is still a matter of speculation. Easter Island is supposed to be the remnant of a greater land which was overwhelmed by the sea after some great earthquake and volcanic eruption, investigation showing some of the largest statues buried to the neck in ashes and scoriæ. Recent scientific analysis and deduction places the race of sculptor-builders as of a proto-Samoan character, inhabiting the land when the seismic catastrophe overwhelmed them probably less than 1,000 years ago, or at a period approximating with the Norman Conquest of England. Alvara Mendaña, according to Spanish geographers, was the first of modern

navigators to discover the island in 1566; it is marked Davis Island on some maps from Edward Davis, buccaneer and adventurer, who reported it in 1686; but the Dutch Admiral Jacob Roggeveen sighted it in 1722 on Easter Day and in commemoration gave the island its present name. The natives then numbered about 3,000 and according to their traditions came from Oparo, one of the Austral group. In 1864 the island was almost depopulated by Peruvians who kidnapped and transported the bulk of the inhabitants to work the guano diggings on the Chincha Islands. Consult Sandberg, H. O., 'Easter Island, the Mystery of the Pacific'; *Pan-American Union Bulletin*, Vol. XXXV, pp. 897–910 (Washington 1912); Churchill, W., 'Easter Island, the Rapanin Speech and the Peopling of Southeast Polynesia' (Washington 1912).

EASTER SUNRISE PILGRIMAGE. The annual "Easter Sunrise Pilgrimage" to the Father Serra Cross (so called from Father Juniper Serra, the founder of the Californian missions), on Mount Rubidoux, about 70 miles from Los Angeles, Cal., is an unusual ceremonial, inaugurated by the late Joseph Riis on Washington's birthday, 1909. This annual service developed until, in the Easter of 1914, over 6,500 people, including many distinguished Americans, attended to hear the reading of a poem by Mr. Henry VanDyke, "God of the Open Air," and to watch a pageant representing some chapters in the history of the valley.

EASTERN EMPIRE, the ancient empire lasting from 395 A.D. to 1453 A.D., which had its metropolis at Constantinople as distinguished from the Western empire with its capital at Rome. It is known also as the Byzantine empire, the Roman empire of the East and the Greek or Later Roman empire. The separation was created by the death of Theodosius in 395, when the Roman empire was divided between his two sons, Arcadius taking the eastern half with his capital at Byzantium or Constantinople, and Honorius the western half with Rome as the capital. See BYZANTINE EMPIRE.

EASTERN QUESTION, The. The rivalry between the Great Powers for control of the Balkans and the political struggle among the Balkan states themselves constitute the Eastern Question. Prior to the 19th century the rivalry between the Great Powers turned upon religion as an ostensible motive, while politics remained at the same time the underlying cause for interference in Balkan affairs. The young and recalcitrant national states of the Balkan Peninsula have always been striving to gain self-government and religious autonomy. The liberation of Serbia was acknowledged in 1804, that of Greece in 1827. Rumania and Bulgaria secured their independence by Russia's support in 1878.

Before the Congress of Paris political control of the Balkans rested largely in the hands of Turkey; after that date the Balkan Question concerned not only Turkey but all Europe. Russia's interest was identified with the protection of Orthodox Christians and the gaining thereby of a route through Constantinople to the Mediterranean Sea; France pretended to protect Roman Catholics in the Levant, in order to maintain there her trade-hold; Austria worked for aggrandizement of her empire through economic and political supremacy consistent with her policy *Drang nach Osten,* which in this case meant *Drang nach Salonika.* Great Britain regarded the safety of the route to her Asiatic possessions as paramount, and Germany planned a commercial outlet through the Balkans to the Persian Gulf.

From the end of the 18th century to the Treaty of Paris (6 March 1856), Russia's policy with Turkey in regard to the Balkans was of the character of the "closed door." She began by allying with Turkey (Unkiar-Skelessi, 8 July 1833), a move which in 1840 was objected to by France, England and Austria, and which Russia opposed in 1850 only to find that Turkey was on the side of her enemies. In 1853 the Russo-Turkish War showed England and France as Turkish allies, and Austria and Germany were neutral till the war had reached the point where the latter two powers threatened to join the Turkish allies if Russia proved intractable. The Treaty of Paris (1856) consequently left Constantinople in the hands of the Turks. Russia gained Sebastopol but she was humiliated to a strict limitation of her armaments in the Black Sea, to withdrawal from the mouth of the Danube by the partial retrocession of Bessarabia, and finally to a renunciation of all special rights to protect Christians in the Ottoman Empire.

Turkey, possessor of the field, continued a Balkan policy of massacre and torture; a massacre of Christians in Syria occurred in 1860, an insurrection in Crete followed, and finally in 1875 an insurrection broke out in Herzegovina. Russia held consistently to her policy, that of Catharine II, to expel the Turks from Europe, but England was split by two parties, that of Gladstone which favored the liberation of the Balkan nations, and that of Lord Beaconsfield which sanctioned Turkish policy. In 1876 the clash came. Serbia and Montenegro arose against Turkey on behalf of oppressed Serbians in Bosnia-Herzegovina. The sympathy of Europe was won for the valiant Balkan fighters. Tennyson in England idealized the Montenegrins as a nation of "warriors beating back the swarm of Turkish Islam for 500 years." Gladstone said: "The Balkans for the Balkan peoples." This was answered later on in Turkey by: "Turkey for the Turks." In 1877–78 Russia carried the cause of the Balkan nations further by marching her army to the very walls of Constantinople and dealing a defeat to Turkey. The Russian forces now sat down with the representatives of the Sublime Porte and dictated the Peace of San Stefano (3 March 1878), by which was declared the complete independence of Serbia, Rumania and Montenegro. Bosnia and Herzegovina were left to the European powers for future decision, yet Austria being the contiguous power was recognized to have a predominating voice in the disposal of the latter. Bulgaria was made an "autonomous principality," which extended from the Black Sea to the Albanian Mountains, and from the Danube to the Ægean.

Thus appeared the complexion of Balkan politics on the eve of the Congress of Berlin (13 July 1878). At this Congress Russia and Austria did not enter with free hands, for previously each had made a secret treaty with the other (at Reichstadt, 8 July 1876) whereby

for Austria's lack of participation in Russia's Turkish imbroglio Russia granted Austria the ultimate disposal of Bosnia and Herzegovina. By the Treaty of Berlin Serbia gained four districts, Nish, Vranye, Pirot and Toplitsa. Montenegro was to receive compensation in lands, accession to the sea and complete independence. Bosnia and Herzegovina fell as spoil to Austria, according to article 25, of the "honest broker's dispensation." Austria justified this stipulation by the need of making peace in that territory. Serbia, not knowing of Austria's secret understanding with Russia, naturally resented the disposal of Bosnia and Herzegovina. A new insurrection broke out in Bosnia (Hadji-Loja), and Bismarck was known to have exclaimed that all the Balkans were not worth the bones of a single Pomeranian grenadier.

The Treaty of Berlin, the Magna Charta of the Near East, did not by any means succeed in securing the peace of the Balkan states. Almost without exception each signatory power violated some provision of this solemn international agreement. Great Britain occupied Cyprus, the third largest island in the Mediterranean, Austria-Hungary annexed Bosnia-Herzegovina, Russia closed and fortified Batum, and Turkey did not introduce promised reforms into Armenia and Macedonia. Even the Balkan states themselves were guilty of violating the treaty, for Bulgaria annexed eastern Roumelia, and Serbia, jealous at seeing the Balkan equilibrium upset, declared war upon Bulgaria, 14 Nov. 1885. Yet the war, lost by Serbia to Bulgaria, brought no issue other than *status quo ante-bellum*, which gave prominence to the alliances existent at that time, of Austria with Serbia, and Russia with Bulgaria — alliances which within the next generation were to be completely reversed.

In Turkey political events following the Congress of Berlin were coincident with the reign of Sultan Abdul-Hamid II, who centralized his government to a great extent. Pan-Islamism ran apace with Pan-Germanism and Pan-Slavism. An alliance was cemented between the sultan and Germany, which was anxious to hold and control the Bagdad Railway (1902). In fact even from 1888 this pact had been growing, while Great Britain since her occupation of Egypt was becoming indifferent to Turkish interests, no longer needing the latter as a foil to Russian aggrandizement in the Middle East. Disturbed by the German advance in the East, however, she came to a *rapprochment* with Russia in 1907, opposing bitterly Germany's aspirations toward the Persian Gulf. More perilous to European peace, however, than any of these issues was the perennial unrest in Macedonia, which threatened again to open up the whole Eastern Question. The situation was due to the internecine struggle of the rival Balkan nationalities: Serbian, Greek and Bulgarian, which aimed at securing the right to reversion of territories not yet derelict. But behind these lesser issues loomed as ever the great rivalries of the Triple Entente (France, Russia, England) and the Triple Alliance (Germany, Austria and Italy). Beyond the European powers the unknown forces of the Mohammedan world were also ominously stirring. The very vastness of the perils involved in any attempt at a definite settlement compelled the powers to accept a compromise which, it was hoped, would restore tolerable conditions in the wretched countries. But the "Mürzsteg programme," concerted between the Austrian and Russian emperors, and imposed upon the Porte by diplomatic pressure did not produce the effect hoped for. In 1908 the powers were still united in bringing pressure to bear on Turkey to make the reforms effective, but the proposal of Great Britain to commit the administration of Macedonia to a Mussulman governor appointed by the Sultan and removable only by consent of the powers, met with little favor either at Constantinople or among the powers whose ulterior aims might have been hampered by this arrangement.

Such was the condition of affairs when in 1908 the revolution in Turkey altered the whole situation. The easy and apparently complete victory of the Young Turks took the whole world by surprise. The question of the Near East seemed in fair way of settlement by the action of the conflicting races themselves, who in the enthusiasm of new-found freedom appeared ready to forget their ancient internecine feuds and to fraternize on the common ground of constitutional liberty. The European powers received the proclamation of the constitution with unanimous approval. Whatever views, however, may have been openly expressed, or secretly held, as to this revolution so far as it affected the Ottoman Empire itself, there could be no doubt that its effects on the general situation in Europe would be profound. These effects were not slow in revealing themselves. Prince Ferdinand proclaimed himself king (tsar) of Bulgaria 5 Oct. 1908; and two days later Emperor Francis Joseph issued a rescript announcing the annexation of Bosnia-Herzegovina to the Hapsburg monarchy. Whatever cogent reasons there may have been for altering the status of these countries in view of the changed conditions in Turkey, there could be no doubt that the method employed was a cynical violation of the public law of Europe. The other powers, confronted with the *fait accompli*, protested, but the astute statesman, Baron von Aehrenthal, then Foreign Minister of the Dual Monarchy, gauged his opposition with Napoleon's *dictum* "Providence is with the big battalions." The discordant Balkan states were quick to grasp this truth, and they temporarily reconciled themselves with circumstances. They realized that it was the immense armed power of Germany that had made Austria the arbiter in a question vitally affecting the interests of the Balkan states. Germany alone emerged from the crisis with prestige enormously enhanced; without her intervention Austria could not have resisted the pressure of the powers.

But Germany being on the side of Austria earned the animosity of the Triple Entente, especially Russia, which urged the Balkan states to form a confederation. Such a confederation should expel the Turks from Europe and, on the other side, be a bulwark against the German drive eastward. The alliance between the Balkan states, Serbia, Bulgaria, Greece and Montenegro, was consummated (1912). Turkey, entangled with Italy in Africa, was not able to meet the demands of the Balkan Allies whose forces marched victoriously on to Constanti-

nople. Austria and Germany, calling a halt, insisted on the London Conference (1913), a conference which gave quasi-autonomy to Albania and put a German vassal selected by the powers upon the Albanian throne. Serbia viewing herself bereft of Albania and the Adriatic coast, while all of Thrace remained in the hands of the Bulgarians, swallowed her resentment for the moment and continued to place confidence in her Greek alliance to the extent of making a new treaty in May 1913. But Bulgaria, secretly prompted by Austria, suddenly attacked Serbia, which was backed by Russia and the active participation of Rumania. The Peace of Bucharest (10 Aug. 1913), concluding the second Balkan war, tried to solve the intimate jealousies and antagonisms by giving Serbia a part of Macedonia, allowing Salonika to Greece, and satisfying Rumania with added territory in Dobrudja. As a matter of fact the Balkan nationalities are never allowed to work out their own destinies; some superior power is always waiting to take a hand. The event which precipitated the Great War of 1914 was the Sarajevo assassination and Austria immediately used it as a *casus belli* against Serbia. The partial refusal of the Austrian ultimatum by Serbia caused war on 28 July, although it has not been proved that Franz Ferdinand's death served Serbian or general Southern Slav ambition at that time.

The entrance into Balkan lands, occurring in August 1914, and the second invasion of northern Serbia in November 1914, marked the defeat of Austrian arms, with Belgrade taken and retaken. Only in November 1915 did Austria and Germany, reinforced by Bulgaria's entry into the war, succeed in bringing about the general retreat of the Serbians through Albania. The arrival of the French and the British in the peninsula which had already begun in August was unable to forestall the fate of their retreating allies, the Serbs and Montenegrins. It was, in fact, the attitude of Greece which paralyzed any forward military moves of the Allies. Venizelos, the Greek Premier, realizing the necessity of allied advance, invited the protection of Greece by the Entente Allied Powers, but the king insisted that the Great Powers were violating Greek neutrality by their presence in that territory. The Greek treaty with Serbia for mutual protection was now fancifully read by Greece to mean «protection against Balkan powers» instead of being construed in its general sense, protection against any power. Nevertheless, a partial recuperation in Serbia saw the beginning of Balkan military activity again in 1916–17. Once more Greece proved obdurate. Resignation of the king appeared the only course to be countenanced, and on 12 June 1917, this event was forced by the Entente Allies.

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EASTERN RITE, Churches of, a name given to various bodies of Eastern Christians who are members of the Roman Catholic Church but who have been permitted to retain many of their ancient customs, which differ from those in general use throughout the world. The Armenians, Coptics, Greeks, Maronites and some others belong to the Eastern Rite. They differ from the Latin Church in nothing doctrinal, only in some matters of discipline. Their liturgy is in the language first used by their bishops and priests, and in no case is the mass said in their vernacular of to-day. For instance, the Syrians use now the Arabic language (in some places modified) but the Maronite liturgy is in the old Syriac language, as used at the time of Christ. (See MARONITES). They differ as to the manner of administering communion; some using for consecration only the leavened bread, others only the unleavened, and some giving communion to the laity under the form of both bread and wine, others using only one of the species as in churches of the Latin Rite. The discipline of marriage for the clergy differs from the Latin Church. Candidates for the priesthood may marry before becoming deacons, not after. All points of difference between the Eastern and Latin Rites are of discipline, not of faith.

EASTERN SHORE, a name given to all that part of Maryland lying east of Chesapeake Bay, and also the counties of Accomac and Northampton in Virginia. Delaware is sometimes included in the Eastern Shore. The country is noted for its fruit and for its mild climate. Great quantities of oysters are taken annually from the waters of the Eastern Shore lands.

EASTERN STAR, Order of the, composed of members of Freemasonry, their wives, sisters, daughters, mothers and widows, may justly be termed a monster fraternity. The membership in 1916 was about 800,000, with a trifle over 8,000 chapters, an estimated gain of about 50,000 a year. In addition to the United States there are chapters in Alaska,

Canal Zone, Cuba, Hawaiian Islands, Philippines, Manitoba, New Brunswick, Quebec, Ontario, Yukon, New Zealand, Australia, Scotland and England. The Order is rapidly extending to all parts of the globe. The largest chapter is Peninsular of Grand Rapids, Mich., with 1,073 members. Illinois has the largest membership, viz., 87,000 with nearly 800 chapters, New York has 60,000, with a little over 500 chapters and all other States have a proportionate membership. Miriam Chapter of Chicago, Ill., the oldest chapter known, was organized as Miriam Family No. 111 6 Oct. 1866, and emerged into a chapter 4 March 1869. New York city, however, has the honor of the birth of the chapter system, Alpha Chapter No. 1 beginning 28 Dec. 1868. Masonic histories state that the Order was introduced into the colonies in New York city in 1778 by, it is supposed, French officers. In the system of 1774 (France) was an emblem of a five-pointed star, presumably copied from the Masonic emblem called the Blazing Star. From an old ritual is evidence that certain members on 18 May 1793 in Boston, Mass., met and formulated a ritual. This work also states Lafayette was interested in the Order. In 1850 Rob Morris, a prominent Masonic lecturer, arranged the degree, calling the bodies constellations. Later he changed the system to families, and still later (1866) the lecture system was adopted. In 1868 Robert Macoy, a Masonic publisher, arranged the chapter system, at the suggestion of certain female members of a society known as "Alpha Sisters of the Eastern Star," with the first meeting as before stated (Alpha No. 1, 28 Dec. 1868). To show how the Order has gained in the Empire State, in 1880 there were 29 chapters, 1,367 members; in 1900, 41 chapters, 2,448 members, and in 1910, 438 chapters and 38,774 members. In New York State the Order has a home and an infirmary for indigent and sick members, with a hundred thousand dollars as a reserve fund to maintain these institutions.

The Grand Chapters of 23 States are jointly interested with the Masonic bodies in the maintenance of homes, and every State has its auxiliaries of societies engaged in some special line of charity. The object of the Eastern Star is principally social and about on the same lines with Freemasonry. It is a secret order; the degrees are imparted with great care; all modern devices are introduced to make the same attractive and effective.

EASTERN STATES, in popular parlance, the six New England States — Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut; in the Mississippi Valley and in the States to the west of it the inhabitants refer to the Eastern States as that section lying east of the Alleghany Mountains.

EASTHAMPTON, Mass., town in Hampshire County, on the New York, New Haven and Hartford and the Boston and Maine railroads, 12 miles northwest of Springfield and in the valley of the Connecticut. The chief manufactures are cotton goods, yarns, buttons, shoeweb, felt, rubber and elastic goods. There is a large dyeing and mercerizing plant and a public library. Williston Seminary, a preparatory school for boys, is located here. Easthampton was settled in 1665, and on 13 May 1704 an Indian attack upon the settlement resulted in 19 killed and much loss of property. It was incorporated as a district in 1785 and was organized as a town in 1809. The government is administered by annual town meetings. The waterworks are owned and operated by the municipality. Three villages are included in the town of Easthampton. Pop. 9,768.

EASTLAKE, Sir **Charles Lock,** English artist: b. Plymouth, 17 Nov. 1793; d. Pisa, Italy, 23 Dec. 1865. He entered the schools of the Royal Academy, where Haydon supervised his education. In 1810 his 'Raising of Jairus's Daughter' brought him to the attention of the public. In 1816 he went to Italy, and for 14 years his home was at Rome, his Italian life being broken by visits to England and Greece. Pictures of banditti and other subjects exhibited in England procured him the associateship of the Academy in 1827. 'Pilgrims Arriving in Sight of Rome' (1828) became so popular that the artist became tired of repeating it in different versions. In 1830 he was made an R.A., his diploma picture being 'Hagar and Ishmael.' 'Escape of Francesco Carrara' (1834); 'Gaston de Foix' (1838); 'Christ Blessing Little Children' (1839), and 'Christ Weeping Over Jerusalem' (1841), were next among his noteworthy productions. 'Helena' (1849); 'Ippolita Torelli' (1851); 'Violante' (1853), may also be mentioned. He translated Goethe's 'Theory of Colors' (1840) and published in 1847 'Materials for a History of Oil-painting.' He became president of the Royal Academy in 1850, being knighted on the occasion; was keeper of the National Gallery in 1843–47, and director of the same institution from 1855 onward. His 'Life' was written by Lady Eastlake (London 1870).

EASTLAKE, Charles Locke, English art critic: b. Plymouth, England. He studied in the Royal Academy schools, but subsequently devoted himself to literary work and design, and was keeper and secretary of the National Gallery 1878–98. He has published 'History of the Gothic Revival in England' (1871); 'Hints on Household Taste' (4th ed., 1874), a book which exerted much influence in its day; 'Lectures on Decorative Art Workmanship' (1876); 'The Present Condition of Industrial Art' (1877); 'Our Square and Circle' (1895); 'Pictures at the National Gallery' (1898).

EASTLAKE, Lady **Elizabeth (Rigby),** English author: b. Norwich 1809; d. 1893. For some years she resided in Germany and at Reval, Russia. Her first book appeared in 1841; it was an account of her sojourn at Reval, entitled 'A Residence on the Shores of the Baltic.' Through a meeting with Lockhart she became a regular contributor to the *Quarterly Review.* In 1848 she married Sir Charles Lock Eastlake, and with him traveled extensively in Italy. In 1848, in the columns of the *Quarterly* she attacked Brontë's 'Jane Eyre,' the episode being one of the least pleasant of her literary career. She was the author of 'The Jewess' (1843); 'Livonian Tales' (1844); 'Music and the Art of Dress' (1852); 'Life of John Gibson, R.A. Sculptor' (1870); 'Life of Mrs. Grote' (1880); 'Five Great Painters' (2 vols., 1883). She edited her husband's works (1870) and his edition of Kugler's 'Handbook of Painting:

Italian Schools' (1874), and translated Brandl's 'Samuel Taylor Coleridge and the English Romantic School' (1886), and Waagen's 'Treasures of Art in Great Britain' (4 vols., 1854–55).

EASTMAN, Charles Alexander (Ohiyesa), American homœopathic physician and author: b. Redwood Falls, Minn., 1858. His father was a Santee-Sioux Indian, Many Lightnings (Jacob Eastman), and his mother a half-breed Sioux, Nancy Eastman. He was graduated at Dartmouth College 1887 and at Boston University School of Medicine 1890. He married the poetess, Elaine Goodale, 1891. He served as government physician at Pine Ridge Agency 1890–93, where he had charge of the wounded prisoners at the time of the Ghost Dance Outbreak, being Indian secretary of the Y. M. C. A. 1894–97. He acted as attorney for the Santee-Sioux at Washington 1897–1900, later becoming government physician at Crow Creek, S. Dak. (1900–03). In 1903 he received an appointment to revise Sioux family names. He became widely known as a lecturer on Indian history and life. He has published 'Indian Boyhood' (1901); 'Red Hunters and the Animal People' (1904); 'Old Indian Days' (1907); 'Wigwam Evenings' (1909); 'The Soul of the Indian' (1911); 'Indian Scout Talks' (1914); 'The Indian Today' (1915). Founder and director of a camp for girls at Munsonville, N. H., 1915.

EASTMAN, Charles Rochester, American paleontologist: b. Cedar Rapids, Iowa, 5 June 1868; d. 27 Sept. 1918. He was graduated at Harvard in 1890; received the degree of Ph.D. from Munich University in 1894; was appointed the same year instructor in geology and paleontology at Harvard and Radcliffe colleges, and became curator of vertebrate paleontology at the Harvard museum. In 1910 he was made professor of paleontology at the University of Pittsburgh, and at the same time curator at the Carnegie museum in that city. In 1914 he accepted a similar position at the American Museum of Natural History, New York, where he is now engaged. He is author, editor and translator of numerous scientific publications.

EASTMAN, George, American inventor: b. Waterville, Oneida County, N. Y., 12 July 1854. As an amateur photographer in Rochester, N. Y., he turned his attention to the production of dry plates, which achieved an instantaneous success. In 1881 the Eastman Dry Plate Company was organized, which developed later into the Eastman Kodak Company. Eastman companies have also been established in London, Paris, Berlin and elsewhere, and the business has now reached vast proportions. The various companies under his management employ upwards of 11,000 hands and over $40,000,000 of capital.

EASTMAN, John Robie, American astronomer: b. Andover, N. H., 29 July 1836; d. 26 Sept. 1913. He was graduated at Dartmouth College in 1862 and became assistant in the United States Naval Observatory. In 1865 he was appointed professor of mathematics in the navy. Retired in 1898 with the rank of captain, he was in 1906 promoted rear-admiral. He was a member of several astronomical expeditions in the United States and accompanied one to Sicily in 1870. He conducted a party to Cedar Keys, Fla., to observe the transit of Venus and subsequently became president of the Washington Academy of Sciences. His works include, besides many reports, 'Second Washington Catalogue' (covering the results of about 80,000 observations made between 1866 and 1891); 'Transit Circle Observations of the Sun, Moon, Planets and Comets' (1903), and a 'History of the Town of Andover, N. H., 1751–1906' (1910).

EASTMAN, Max, American editor and lecturer: b. Canandaigua, N. Y., 4 Jan. 1883. He was graduated at Williams College in 1905, and then pursued a post-graduate course at Columbia University (1907–10), during which time he was also assistant in philosophy. In 1911 he was associate professor at Columbia, but abandoned teaching for literary and social reform work after that year. Mr. Eastman, as editor of *The Masses*, has been prominently connected with the Socialist party. He is also active as a lecturer and as a promoter and actor in the Provincetown Players. When the publication of *The Masses* was suppressed in 1918, the company with Mr. Eastman at its head was reorganized for the publication of *The Liberator*. He is also the founder of the first Men's League for Woman Suffrage in the United States (1910–12). Besides contributions to his own and numerous other magazines, Mr. Eastman is the author of 'Child of the Amazons and Other Poems' (1913); 'Enjoyment of Poetry' (1913); 'Journalism Versus Art' (1916); 'Understanding Germany, . . . and Other Essays' (1916).

EASTMAN, Seth, American soldier: b. Brunswick, Me., 1808; d. 1875. He was graduated at the United States Military Academy in 1829 and became a lieutenant in the First Infantry. He performed frontier duty at forts Crawford (1829) and Snelling (1830), and in 1831–33 was on topographical duty. From 1833 to 1840 he was assistant instructor in drawing at the Military Academy. He served in the Bureau of Indian Affairs in 1850–57 as illustrator of 'The History, Condition and Future Prospects of the Indian Tribes of the United States.' In 1861 he was made a lieutenant-colonel of infantry, was retired two years later and brevetted brigadier-general in 1866. He published 'Treatise on Topographical Drawing' (1837).

EASTON, Morton William, American philologist: b. Hartford, Conn., 18 Aug. 1841. He was graduated at Yale in 1863 and at Columbia in 1866, and afterward studied at the University of Vienna. He was for several years professor of comparative philology in the University of Tennessee and later (1882–1912) in the University of Pennsylvania, and professor emeritus since 1912. His writings include 'Observations on the Platform at Persepolis' (1892); 'Readings in Gower' (1895), and numerous papers on Phonetics, Sanskrit, Iranian and English to *The Journal of the American Oriental Society, The American Journal of Philology* and other periodicals.

EASTON, Nicholas, American colonial statesman: b. Wales 1593; d. Newport, R. I., 15 Aug. 1675. Emigrating to America in 1634, he was the first settler in Agawam, now Newbury, Mass., 1635. He built the first English

house in Hampton, N. H., 1638, and the first one on the site of Newport, R. I., 1639, and was elected president of Providence Plantations 1649 and 1654. He was deputy governor of Rhode Island for four years, and governor 1672–75. His son, John Easton, was governor 1690–95, and wrote a 'Narrative of the Causes which led to King Philip's War,' edited by F. B. Hough (Albany 1858).

EASTON, Mass., town in Bristol County, on the New York, New Haven and Hartford Railroad, about 25 miles south of Boston. The town includes several villages and has important manufactures of shovels, thread, foundry and machine-shop products, hardware, automobiles, shoes, shoe heels and wire. It has a public library and some fine public buildings, gifts of the Ames family, showing some of the best work of H. H. Richardson and John Lafarge. Pop. 5,083.

EASTON, Md., town and the county-seat of Talbot County, on the Philadelphia, Baltimore and Washington, and the Baltimore, Chesapeake and Atlantic railways, about 28 miles southeast of Annapolis, 50 miles south-southeast of Baltimore, near a navigable inlet of Chesapeake Bay. It is the seat of a Protestant Episcopal bishop and has a fine county building, high school, churches, etc. It is the market centre for a rich grain and fruit-growing country. The manufactures are chiefly iron machinery, fertilizers, carriages, wagons, handles and spokes, lumber, bricks and tile, flour, canned fruits, furniture and shorts. It is connected with Baltimore by steamship lines. Easton is governed by a mayor and council. The waterworks, electric-light plant and sewage system are owned by the city. Pop. 3,083.

EASTON, Pa., city, county-seat of Northampton County, situated at the extreme eastern part of the State, on the banks of the Delaware River, at its confluence with the Lehigh River and the Bushkill Creek, 74 miles west of New York and 65 miles north of Philadelphia, scarcely two hours distant by rail from each city.

Railroads and Canals.— Through Easton pass the two great trunk lines, Lehigh Valley and the Central Railroad of New Jersey, and the smaller local roads, Lehigh and New England, Easton and Northern, Easton and Western and the Bangor and Portland railroads. Immediately across the Delaware River from Easton is located the thriving city of Phillipsburg, population about 18,000. Through this town run the Belvidere and Delaware division of the Pennsylvania Railroad, and the Lehigh and Hudson Railroad, which make direct connections with the Hudson River Valley and the New England States, also the Delaware, Lackawanna and Western Railroad. Seventy-seven passenger trains arrive and depart from Easton daily and 159 freight trains. There are two canals, Morris and Essex from Phillipsburg, N. J., to New York, traversing the entire State of New Jersey, and Lehigh Canal, offering direct communication from the anthracite coal regions to Philadelphia and its tide water points, connecting at Lambertville with the Delaware and Raritan Canal. The Atlantic Deeper Waterway Commission of the United States is dredging the channel of the Delaware River from Trenton to Easton, so that ocean-going barges of 1,000 tons capacity can load and unload at Easton and ultimately at Martin's Creek and Bethlehem.

Electrical Roads.— The Easton Transit Company has a splendid suburban system reaching all local points and interurban lines out to Alpha, N. J., where large cement works are located, and to Bethlehem, South Bethlehem and Nazareth. These lines make direct connections with all points in the Lehigh Valley and at Allentown for Philadelphia. Another system, the Philadelphia and Easton, extends from Easton to Philadelphia, via Doylestown and Willow Grove, traversing the right bank of the Delaware River for 15 or 18 miles and affording scenery unsurpassed by any trolley road in the United States. Two other roads, the Northampton Traction Company and the Northampton, Easton and Washington Traction Company (familiarly known as the Hay Lines), extend both in Pennsylvania and New Jersey from Easton. The first named extends from Easton to Nazareth, the centre of the cement belt of the United States, and to Bangor, the centre of the slate producing region of this country, thence to the Delaware Water Gap and Stroudsburg, reaching the very heart of the Pocono Mountains, the famous mountain resort of the Eastern States. The Jersey road, called the Northampton-Easton and Washington, extends from Phillipsburg due east through the Musconetcong Valley almost to Hackettstown, through the important points, New Village and Washington. It is intended in the near future to connect this line with Lake Hopatcong. When finished it will be possible for passengers starting anywhere in the Lehigh Valley to proceed by trolley, all the way to New York, Boston and far off Maine, and from Philadelphia to the Pocono Mountains.

Climate and Surroundings.— The climate of Easton is particularly good. The great Blue Mountain Range shuts off the harsh winter winds which have so sorely injured other places. The summers are fine. The rivers offer bathing and boating for its young people. The rivers cutting through the mountain chains give it a scenic setting not surpassed by any city in this broad land. The soil immediately surrounding Easton is wonderfully fertile and Northampton, of which Easton is the county seat, is far famed for the wealth of the farms' resources of its soil.

Manufactures.— The industries are wonderfully varied and Easton is signally fortunate in the character of its labor. At least 60 per cent of its men wage earners own their homes. This gives Easton a class of skilled men and fine citizens, foremost in every good work and public cause. The factories make almost everything from pig iron and steel castings and machines down to delicate silk underwear, hosiery, silks and small articles of every day use. Among the industries and their products are Ingersoll-Rand Company, mining machines, air compressers, drills, etc., Taylor Wharton Iron & Steel Co., steam railroad and electrical supplies, frogs, switches, special work, etc., Treadwell Engineering Company, steel casings, mining machinery, separators, etc., Victor Balata Textile and Belting Company, machinery belts. The silk industry is very large. Over 5,000 operators

work in the silk mills of Easton and Phillipsburg, making broad silks, velvets and ribbons. C. K. Williams Company, ground paints and ground stone; General Crushed Stone Company, crushed stone, among the largest in the United States. Many flour mills. Charles Chipman Sons, hosiery; a very large concern; H. Lehr & Company, pianos; Lehman Brothers, silk and cotton underwear for ladies. Rinek Cordage Works, cordage; Binney & Smith, pencils and crayons, one of the largest in the world; Easton Finishing Company carton finishers; American Flag Company, flags and bunting; Fitzgerald, Speer & Company, doors and sash; American Horse Shoe Works, horseshoes; Canister Company, making cans and packages for grown products; General Chemical Company (Baker & Adamson Branch), and J. T. Baker Chemical Company, general chemicals and acids; Tippett & Wood, stand pipes and reservoirs. The repair shops of the Lehigh Valley employing about 750 men. Northern Ore Company have one pig iron furnace within a mile and a half of Easton. The Kuebler Foundries, malleable, cast iron and general iron works and the Easton Brass and Finishing Works. Within a radius of 10 miles there are 10 cement plants with a very large output. There are numerous other industries of various kinds, all uniting to make Easton a great manufacturing centre.

Business Conditions and Stores.— Easton is a natural trading centre for a large surrounding country both retail and wholesale. Over 200 commercial travelers leave Easton every Monday morning representing the large wholesale grocers, produce, dry-goods, boots and shoes, hardware, stoves, confectionery and other local houses. There are three large department stores, selling not only to Easton people, but the surrounding country about 40 miles north and south; 30 miles to the east and 12 miles to the west, with an aggregate business of $2,500,000 per annum. The art, jewelry, drug, piano, phonograph stores, clothing, confectionery, books, millinery and other trades are important.

Banks and Trust Companies.— Easton has three national banks and two trust companies, and Phillipsburg, N. J. (across the river), has two national banks and one trust company. Phillipsburg, N. J., and Easton, divided by an arbitrary and imaginary State line and the Delaware River, are to all intents and purposes one commercial community. Many doing business in Phillipsburg reside in Easton, and vice-versa. The combined capital of the banks and trust companies is $1,550,000; the combined surplus and undivided profits are $1,786,917; the combined deposits of these banks and trust companies are over $18,000,000. One of these banks, the Easton National, celebrated its 100th anniversary a year ago, still retaining its old name "Easton," it being originally a State bank.

Colleges and Schools.— Easton is the seat of Lafayette College founded and named after the Marquis de Lafayette at the time of his second visit to America. It has a national reputation; over 700 students enrolled, with numerous and well-equipped departments in every branch of science and literature. Easton is the birthplace of Governor Wolfe, long deceased, founder of the public school system in Pennsylvania, and father of the public school system in the United States. A beautiful memorial arch in front of the high school building commemorates this fact. The public schools are unsurpassed and Easton has a number of private, preparatory and parochial schools and is a noted centre of learning, culture and education with a splendid public library, supported by local taxation, an original Carnegie foundation.

Newspapers and Magazines.—There are two daily, old and largely circulated newspapers; all evening papers published every day except the Sabbath; each of these papers has a semi-weekly and weekly edition; one Sunday paper called the *Sunday Call*, of large circulation and great importance, with a weekly edition, the *Easton Sentinel;* a German paper, the *Northampton Demokrat;* a number of trade journals issued semi-monthly and monthly, particularly the *Easton Labor Journal, Chemical Journal, Lafayette College Weekly, Lafayette College Monthly* and a number of periodicals of special trades.

Churches and Clubs.— Easton and Phillipsburg being one community interchange their church people, and with a combined population of about 50,000 have the following churches: Lutheran 11, Presbyterian 9, Reformed 5, Methodist Episcopal 6, Protestant Episcopal 2, Moravian 1, Baptist 5, Evangelical 4, Roman Catholic 4, Christian Science 1, Jewish synagogues 2, Mennonite 1, Salvation Army 1 barrack, Italian Missions 2. The services in these churches are held in English, German, Italian, Hebrew and Slovak, indicating the diversity of the nationalities of the worshipers. The religious and charitable element of Easton have a spendid hospital which they are about to rebuild at a cost of $250,000. Also a Y. M. C. A. and Y. W. C. A., old ladies' home and a home for friendless and orphan children and a charity organization society. Fraternal orders and societies are numerous and strong and Easton has a number of social clubs; the Pomfret Club, the Northampton Country Club; the McKinley Club, the Northampton Republican and Jacksonian Democratic Clubs, all owning their own homes; the Triakas Club, and numerous others. The club and social life in Easton is ideal, pleasant and extensive.

History.— Easton is an old "Penn" town. It was an original outpost and trading place of the early settlers with the Indians. Within its borders were enacted many important treaties with the aborigines. In 1739 David Martin built his ferry house at the foot of the present Ferry street to convey passengers across the Delaware River. The entire site of the town was then covered with forests and bushes. The only signs of life were the few settlers, white men, and their neighbors, the Indians. The Delaware and Lehigh rivers were the channels of transportation for the Indians in their canoes. It was the garden spot of the Lenni Lenape and Delaware Indians. The landing point for their canoes was a long sandy place at the junctions of the Delaware and Lehigh rivers and still retains its name "The Point." The Delaware and Lehigh rivers were filled with shad in running season. The Indians caught them by the thousands. On the peninsula formed by the Bushkill and Lehigh rivers with the Delaware, William Parsons, the surveyor-general of Pennsylvania and confidential man of the "Penns," located the present city of Easton. In 1752 it was formally laid out, with wide streets, north and south, east and west and

as in all "Penn" towns, with a small square or public commons, now "Centre Square," in the centre of the small level area which the new town afforded, hemmed in then as now by great hills. In 1789 it was incorporated as a borough. Easton was always the banking and trading centre of a large section. As far north as New York and Canada its venturesome traders and merchants sold their goods and as far west as the Susquehanna and Ohio rivers. It has not lost any of its commercial and trading instincts; it is still essentially a trading town. In the last few years only Easton has awakened to full conception of its wonderful advantages and possibilities, and has become a great railroad and great manufacturing centre. In 1887 it was chartered as a city. Since 1913 it has been administered under a commission form of government. Electrically lighted streets are well paved with brick, asphalt and amiesite, and a salaried fire department and efficient police force afford ample protection. Pop. (1900) 25,238; (1910) 28,523; (1918) est. 35,000.

THOMAS A. H. HAY,
Secretary Easton Board of Trade.

EASTPORT, Me., city and port of entry in Washington County, on Moose Island, in Passamaquoddy Bay, and on the Maine Central Railway, 190 miles east-northeast of Portland. A bridge crosses the narrow channel to the mainland. It is the northeast frontier city of the United States, and has a fine harbor, which on account of its high tide, 25 feet, is clear of ice all the year, and has daily steamship service with Boston, Calais and Portland. Eastport and the island of Campobello, on the opposite side of the harbor, are popular summer resorts. The city has extensive fishing and shipbuilding interests, and is the centre of the American sardine-canning industry, with 20 factories. It also manufactures shoes, box hooks, etc. It has a custom-house, public library, the Boynton high school, churches, national and savings banks, weekly newspapers, and is lighted by electricity. Eastport was settled about 1782. The islands in Passamaquoddy Bay were long under dispute and claimed by Great Britain. The town was captured by an English force 11 July 1814 and held under strict martial law until 30 June 1818. Its trade was severely crippled by the Embargo Act, and the town was for several years, especially during 1807–18, notorious as a smuggling centre. The government is administered under a charter of 1893, by a mayor, elected annually, and a board of aldermen. Consult Kilby, 'Eastport and Passamaquoddy' (Eastport 1888). Pop. 5,000.

EASTWARD HO! a comedy written by Marston, Chapman and Johnson, and produced in the season of 1604–05. It is best known for its satire on the Scotch, which caused the imprisonment of its authors.

EASTWICK, Edward Backhouse, English Orientalist and diplomatist: b. Warfield, Berkshire, 13 March 1814; d. Ventnor, Isle of Wight, 16 July 1883. After studying at Merton College, Oxford, he became professor of Hindustani at the college at Hailebury and assistant political secretary in the India office in 1859. He served as secretary of legation in Persia (1860–63); commissioner for the Venezuelan Loan venture, and as private secretary to Lord Cranborne, Secretary of State for India. He was a voluminous writer on Oriental (especially East Indian) subjects, and rendered very important service to English literature by many translations from Persian and Hindu, for example: Sadi's 'Gulistān,' or 'The Rose Garden' (1852); and the version of Pilpay's fables called 'Anvār-i-Suhailī' (1854). He also wrote a 'Journal of a Diplomat's Three Years' Residence in Persia' (1864); and 'Venezula,' or 'Sketches of Life in a South American Republic' (1868). Between 1878 and 1882 he brought out a sumptuous edition of the 'Kaisar-nama-i-hind,' or 'Lay of the Empress.' He was a frequent contributor to literary journals.

EATON, Amos, American scientist: b. Chatham, N. Y., 1776; d. 1842. He was graduated at Williams College 1799; settled in Catskill, N. Y.; practised law, and engaged in civil engineering, while prosecuting studies in chemistry, geology and mineralogy. He made a survey of Albany and Rensselaer counties 1820, and later of the Erie Canal region. In 1824 he became senior professor of the Rensselaer School of Science in Troy, now the Rensselaer Polytechnic Institute. Among his works are 'An Index to the Geology of the Northern States' (1818); 'A Manual of Botany of North America' (1833); and 'Geological Note-Book' (1841).

EATON, Arthur Wentworth Hamilton, American clergyman and author: b. Kentville, Nova Scotia, 1859. He was graduated from Harvard in 1880, entered the university of the Protestant Episcopal Church, and served at Chestnut Hill, Mass., 1885–86. He then settled in New York, where he taught literature, wrote and preached. Since 1907 has lived in Boston. He is the author of many books: 'The Heart of the Creeds; Historical Religion in the Light of Modern Thought' (1888); 'Acadian Legends and Lyrics' (1889); 'The Church of England in Nova Scotia and the Tory Clergy of the Revolution' (1891); 'Tales of a Garrison Town' (with C. L. Betts, 1892); 'Acadian Ballads' (1905); 'Poems of the Christian Year' (1905); 'The Lotus of the Nile and Other Poems' (1907); 'The History of King's County, Nova Scotia, Heart of the Acadian Land' (1910); 'The Famous Mather Byles' (1914). Also various books compiled and edited (1890–1901); and many historical and biographical monographs (1885–1917). Degrees: B.A. Harvard 1880; M.A. Dalhousie (Halifax) 1904; D.C.L. King's (Windsor, Nova Scotia) 1905.

EATON, Charles Warren, American artist: b. Albany, N. Y., 22 Feb. 1857. He studied at the National Academy of Design, and the Art Students' League, New York and in London; and is a member of the American Water Color Society, New York. He exhibited at the Paris Exposition 1900; the Pan-American Exposition 1901. He received the Proctor prize 1901, the Inness prize 1902 and Shaw prize 1903 at the Salmagundi Exhibition. He received a silver medal at the Saint Louis Exposition in 1904. Among his landscapes are 'The Forest'; 'October's Tints'; and 'Connecticut Pines'; 'Gray Dunes' and 'Forest Lands' (1911); 'The Valley of Sunset' (1912) and 'Gathering Mists' (1913).

EATON, Dorman Bridgman, American lawyer: b. Hardwick, Vt., 27 June 1823; d. New York, 24 Dec. 1899. He was graduated at the University of Vermont in 1848 and at the Harvard Law School in 1850; was admitted to the New York bar; and later became widely known by his advocacy of civil service reform. In 1883 he was appointed a commissioner of the United States Civil Service Commission, resigning in July 1885. He was reappointed in November of the same year, but again resigned in April 1886. In the latter year he drafted the laws which created the Metropolitan Board of Health of New York; subsequently those on which the present police courts were organized; and in 1883 the National Civil Service Act. His publications include 'The Independent Movement in New York' (1880); 'Civil Government in Great Britain' (1880); 'The Term and Tenure of Office' (1882); 'The Problem of Police Legislation' (1895); and 'The Government of Municipalities' (1899).

EATON, Edward Dwight, American educator: b. Lancaster, Wis., 12 Jan. 1851. He was graduated at Beloit College in 1872, from Yale Theological School three years later and studied also at the universities of Leipzig and Heidelberg in 1875–76. He was ordained to the Congregational ministry in 1876, was pastor at Newton, Iowa, 1876–79 and of the First Congregational Church at Oak Park, Ill., from 1879 to 1886. Since 1886, with the exception of two years (1905–07) spent as pastor at Saint Johnsbury Vt., he has been president of Beloit College. He was member of a delegation sent in 1898 to inspect Congregational missions in China. He was Southworth lecturer at Andover Theological Seminary in 1904 and Pond lecturer at the Bangor Theological Seminary in 1906. Since 1910 he has served as vice-president of the American Board of Commissioners for Foreign Missions, and since 1911 as chairman of the Wisconsin College Association.

EATON, John, American educator: b. Sutton, N. H., 5 Dec. 1829; d. Washington, D. C., 9 Feb. 1906. He was graduated at Dartmouth College in 1854; studied theology; and in 1862 became chaplain of the 27th Ohio Volunteer Infantry. Subsequently he was appointed superintendent of freedmen for Mississippi, northern Louisiana, Arkansas and west Tennessee, and remained on duty till May 1865. He was brevetted brigadier-general of volunteers in 1865. He was editor of the Memphis (Tenn.) *Post* in 1866–67, and State superintendent of public instruction for Tennessee (1867–69). In 1871–86 he was commissioner of the United States Bureau of Education; from 1886–91 he served as president of Marietta College; in 1895 became president of Sheldon Jackson College at Salt Lake City; and in 1898 was appointed a special commissioner to arrange for the establishment of the American system of education in Porto Rico. His publications include 'History of Thetford Academy'; 'Mormons of To-day'; 'The Freedmen in the War' (report); 'Schools of Tennessee' (report); and reports of the United States Bureau of Education.

EATON, John Henry, American statesman: b. Tennessee, 1790; d. 1856. He practised law in Nashville, and was Secretary of War 1829–34, when he became governor of Florida. He was appointed Minister to Spain 1836, and published a 'Life of Andrew Jackson' (1824).

EATON, Margaret O'Neill ("PEGGY O'NEILL"); b. Washington, 1796; d. 1879. As the wife of Maj. J. H. Eaton, Jackson's Secretary of War, she was the subject of a social war in government circles owing to certain charges connecting her name with that of Major Eaton, while she was still wife of purser Timberlake, her first husband. It was said that from this social disturbance arose an estrangement between General Jackson and Calhoun, leading to the nomination of Van Buren for the presidency 1836. After the death of her second husband she married a third, an Italian dancing-master, much her junior, from whom she was divorced.

EATON, Seymour, American author: b. Epping, Ont., 1859; d. Lansdowne, Pa., 13 March 1916. After seven years of district school teaching he became a resident of Boston. He started later in Philadelphia the Booklovers Library and the Tabard Inn enterprise. The feature of the Booklovers Library was a delivery system whereby subscribers received the latest literature at their homes. Branches were opened in American cities and in Europe, and the business increased until Mr. Eaton felt it necessary to organize a subsidiary system called the Tabard Inn Library, which permitted purchasers to get books at the regular retail price and to exchange any volume for another on payment of five cents. Mr. Eaton founded next the *Booklovers Magazine,* which made a specialty of the reproduction of famous paintings. Then druggists' specialties and food preparations were taken up, and finally Tabard Inn undertook the manufacture of artistic house furnishings. Tabard Inn became a $12,000,000 corporation and sold a good deal of stock before going into the hands of a receiver in 1905. After the insurance investigation of 1906 he became secretary of the international policyholders' committee, but resigned after a dispute with the committee's managers. For five years he was director of Drexel Institute in Chicago and for four years a daily contributor to the Chicago *Record.* He wrote 'The Teddy Bears Musical Comedy,' 'Prince Domino and Muffles,' 'The Telepath'; 'Barzillai Brown,' 'Bachelor,' 'The Mysterious Giver,' and a series of pamphlets setting forth short cuts to business success. He was long credited with being the "creator of the famous teddy bears." The fact is that the toy bearing that name was originated in Germany by Margaret Steiff, a poor woman, who became prosperous through the success of these toys and now has factories employing 5,000 persons. When first imported here the bears were not called "teddy bears." That name became attached to them a year or two later, after illustrated verses by Mr. Eaton, dealing with the adventures of the "Roosevelt Bears," or the "Teddy Bears" were printed in the Sunday newspapers. So apparently Mr. Eaton is to be credited with the name, but not with the figures themselves.

EATON, Theophilus, American colonial governor: b. Stony Stratford, Buckinghamshire, England, about 1591; d. New Haven, Conn., 1658. He came over to Massachusetts with the

Rev. John Davenport, 1637, founding with Davenport the town and colony of New Haven, in 1638. He was chosen governor October 1639, and re-elected annually as long as he lived. He was prominent in the organization of the New England Confederation 1634, and the so-called Connecticut "Blue Laws" were drawn up by him, assisted by Davenport, 1655.

EATON, Timothy, Canadian merchant: b. Clogher, Ireland, October 1835; d. Toronto, Canada, 31 Jan. 1907. While a boy he was apprenticed to a draper at Portglenone, but having served his five-year term and received his wages of about £100, in 1857 he emigrated to Canada. He first opened a store at Kirkton, in Huron County; later went to Saint Mary's; and finally settled in Toronto, where, in 1869, he opened the store which has since expanded into one of the largest department stores in America, with a branch at Winnipeg.

EATON, William, American officer: b. Woodstock, Conn., 23 Feb. 1764; d. Brimfield, Mass., 1 June 1811. He served in the army 1780–83, and then went to Dartmouth College, where he was graduated 1790. Becoming captain in the United States army in 1792, he served in campaigns against the Indians till 1798, when he was sent to Tunis as American consul. During the war against Tripoli in 1801 he resolved to re-establish Hamet Caramelli as Bey of Tripoli, but was not supported in his attempt by the American naval officers. He returned to America in 1803 and was subsequently appointed naval agent of the United States for the Barbary powers. Returning to Africa he captured the city of Derne 27 April 1805, but when the United States concluded a treaty of peace with the usurper Yussuf, Eaton returned to America. See DERNE EXPEDITION.

EATON, Wyatt, American painter: b. Phillipsburg, Quebec, 1849; d. 1896. He came of American parentage, removed early in life to New York and studied at the National Academy of Design and under Gérôme at the École des Beaux-Arts, Paris. He also associated with Millet at Barbizon and his work was greatly influenced by this artist. Eaton dissociated himself from the various schools and went to the old masters for his inspiration. His portraits form the most notable part of his work, in which he almost invariably caught much of the personality of the subject. The best known are the series of American poets, engraved by Cole for the *Century Magazine.* Notable portraits are those of Cole, Mrs. Richard Watson Gilder, W. C. McDonald and Archie Gordon. He was one of the founders and first secretary of the Society of American Artists. Of his subject pictures the most widely known are 'Harvesters at Rest' (1876, Smith College); 'Reverie' and 'Harvest Scene,' in the Montreal Gallery.

EATON, Ohio, village, county-seat of Preble County, on the Pittsburgh, Cincinnati, Chicago and Saint Louis Railroad, 58 miles northwest of Cincinnati. Its industrial establishments comprise glove factories, cigar factories, and cement plants. It has also extensive agricultural interests, a library, and a water-supply system. Nearby are many remarkable springs. The town saw here the struggle between the Indians under Little Turtle and the white pioneers led by John Adair. Pop. 3,187.

EATONTON, ē'tŏn-tŏn, Ga., city, county-seat of Putnam County; on the Central of Georgia Railroad; on the Oconee River, about 68 miles southeast of Atlanta. The city has extensive agricultural, cotton and fruit-growing interests. Its industrial establishments include cotton factories, gins, and compresses, and creameries. The fruit trade is considerable. The city owns the water supply system and sewage disposal plant. It is the birthplace of Joel Chandler Harris, of Uncle Remus fame. Pop. 2,036.

EAU, ō, a French word signifying water, and used in English with some other word for several spirituous waters, and particularly perfumes: (1) *Eau de Cologne,* a fragrant water made originally and in most perfection in Cologne. It was invented by Farina. It is manufactured by adding to distilled alcohol a few aromatic oils. Although there are three firms which claim the original invention, the general process of manufacture is known. The important factors are the quality of spirit used and the amount of time allowed for maturity. Distillation produces equally good effects. The synthetic oils used by various perfumers are in the typical combination as follows: 30,000 grams spirit; 100 neroli oil; 30 rosemary oil; 100 Mitchem lavender oil; 300 lemon oil; 300 bergamot oil; 50 petit-grain oil. (2) *Eau Crëole,* a highly esteemed cordial made in Martinique, West Indies, by distilling the flowers of the mammee apple with spirit of wine. (3) *Eau de Javelle,* a preparation of chloride of soda, used as an antiseptic, and a bleaching agent. (4) *Eau de Luce,* invented by a person named Luce, at Lille, in Flanders, is a volatile preparation, made from oil of amber, alcohol, and ammonia. It is a milky fluid, powerfully antispasmodic, and stimulant. Mixed with nitric acid it forms a substitute for musk. (5) *Eau de Paris,* a substitute for cologne, and which is sometimes taken in sweetened water as a cordial, and stimulant. (6) *Eau de Vie,* a brandy; specifically the less perfectly purified varieties, the best being called cognac. (7) *Eau de vie de Dantzig,* a white liqueur, or cordial, sweet and strong, in which are introduced for ornament small particles of gold-leaf. (8) *Eau de vie d'Hendaye,* a sweet French cordial, of which there are three varieties — white, green and yellow. Consult Otto, 'Les Parfums'; Mann, 'Die Moderne Parfumerie.'

EAU CLAIRE, ō klār, Wis., city and county-seat of Eau Claire County, at the mouth of the Eau Claire River, and the head of navigation of the Chippewa River, and on the Chicago and Northwestern; Chicago, Milwaukee and Saint Paul, and several other railroads; 85 miles east of Saint Paul and 150 miles northwest of Madison. It is the commercial centre for northwestern Wisconsin, and the outlet of the Chippewa lumber district, with extensive water power. It has a great trade in lumber and manufactures over 300,000,000 feet annually. There are extensive manufactures of iron and linen goods, furniture, refrigerators, boxes, harness, sashes and doors, machinery and shoes. The city is noted as a summer resort, and has electric railroads and street lights, waterworks, public library and high school, Sacred Heart

Hospital, Norwegian Lutheran Hospital, national and savings banks, daily and weekly newspapers. Eau Claire adopted the commission form of government in April 1910, being the first city in the State to do so. Pop. 18,647.

EAUX-BONNES, ō-bŏn, France, a celebrated watering-place, department of Basses-Pyrénées, at the bottom of a narrow gorge, about 25 miles south of Pau. There are seven hot springs, which have a temperature of about 90°, are strongly impregnated with sulphur and considered of special efficacy for throat diseases and tuberculosis. About 6,000 to 10,000 visitors resort hither in the course of the season, which lasts from June to October. A short distance away is Eaux-Chaudes, with sulphur springs.

EAUX-CHAUDES, ō-shōd, France, a watering-place in France, three miles southeast of Eaux-Bonnes. Some of its springs have the same properties as those of the Eaux-Bonnes, and others are more strongly impregnated with sulphur.

EAVES or **CLIFF SWALLOW,** one of the familiar North American swallows (*Petrochelidon lunifrons*) common about buildings where, as explained under BARN-SWALLOW, it has taken up its residence as fast as the country became settled. It is to be recognized by the squareness of the tail (not deeply forked as in its larger associate, the barn-swallow), the chestnut rump, whitish belly and blue spot on the breast. It is most peculiar, however, in its nests, which are always attached to the outside of the building, and usually in close row under the protection of the eaves. These nests are made of pellets of mud; are shaped like bulbous flasks with a curved neck forming an entrance; and are attached by their base to the wall. In the primitive wilderness these nests are attached in crowded colonies to the faces of cliffs, where whole masses would frequently scale off by reason of the weight or of the loosening action of rain. Much safer and better conditions are found under the protection of the eaves of buildings; and not only has this swallow everywhere taken advantage of this fact, but striking modifications in their architecture have followed. The eggs closely resemble those of the barn-swallow, and two broods are usually raised. The species abounds in suitable localities all over the continent, migrating to the tropics in winter.

EAVESDRIP, an ancient custom, or law, corresponding to the well-known urban servitude of the Romans called stillicide, where a proprietor was not allowed to build to the extremity of his estate, but must leave a space regulated by the charter by which the property was held, so as not to throw the eavesdrop on the land of his neighbor.

EBAL, ē'bal, a mountain in Palestine, nearly 3,000 feet in height; 35 miles north of Jerusalem, situated north of Mount Gerizim, from which it is separated by a narrow valley containing the town of Nablus, anciently Shechem. Here the Israelites were commanded, on their entrance into the Holy Land, to set up an altar to Jehovah of hewn stones. The fulfilment of this is recorded in Joshua (viii, 30–35). From Mount Ebal the curse for disobedience to the law was pronounced, the blessing for obedience being given from Mount Gerizim, which lies across the valley. The modern Arabic name of Ebal is Jebel Eslamiyah.

EBELIANS, German sect, named after Ebel, a Prussian archdeacon, one of the founders. It arose in Königsberg, Prussia, about 1836, the Archdeacon Ebel and Dr. Diestel being its leaders. They believed in spiritual marriage. In 1839 sentence was passed against their leaders, who were charged with unsound doctrine and impure lives, but it was removed in 1842. Their enemies called the sect Mucker, that is, in German, hypocrites.

EBELING, ā'be-lĭng, **Christoph Daniel,** German scholar: b. Garmissen, near Hildesheim, Hanover, 20 Nov. 1741; d. Hamburg, 30 June 1817. He was noted for his extensive knowledge of Oriental languages, of classic and foreign literature, and of history and geography. He published a history and geography of North America (1796–1816), for which he received the thanks of the United States Congress. He paid special attention to the geography of the New World, and collected about 10,000 maps and nearly 4,000 books, all relating to America. This library was purchased in 1818 by Israel Thorndike of Boston, and presented by him to Harvard College.

EBENEZER, ĕb-ĕ-nē'zẽr (Heb. "the stone of help"), commonly used as any memorial of divine assistance, originally the name of a field where, at Samuel's request, the Lord discomfited the Philistines with thunder, etc. On this occasion Samuel set up a stone and gave it this designation, to indicate that the Lord had helped them. The site has never been definitely ascertained.

EBENSBURG, Pa., borough and county-seat of Cambria County; on a branch of the Pennsylvania Railroad, about 113 miles east of Pittsburgh and 16 miles west of Altoona. The manufactories include woolen-mills, tanneries, a foundry and saw-mills. It is about 2,300 feet above sea-level and enjoys some reputation as a health resort. It is situated in a rich bituminous coal region. Pop. 1,978.

EBERHARD, ā'bĕr-härt, **Christian August Gottlob,** German poet and descriptive writer: b. Belzig, 12 Jan. 1769; d. Dresden, 13 May 1845. His idyl 'Little Hans and the Chickens' (1822) has been translated into many languages and still enjoys a wide popularity. His long poem in hexameters, 'The First Man and the Earth' (1828) is distinguished by its noble diction.

EBERHARD, Johann August, German philosophical writer: b. Halberstadt, 31 Aug. 1739; d. there, 6 Jan. 1809. He was a preacher first in Berlin and then in Charlottenburg, and was appointed to the chair of philosophy at Halle in 1778. He first attracted attention with a 'New Apology of Socrates' (1772), an attack upon the narrow theology of the day, to which succeeded 'Universal History of Philosophy' (1788); 'Handbook to Æsthetic' (1803–05); and other works from a Wolffian standpoint, in harmony with Leibnitz and in opposition to Kant.

EBERHART, Adolph Olson, American public official: b. Sweden, 23 June 1870. He is a son of Andrew Olson and in 1898 by permission of the court changed his name because of several Adolph Olsons living in same town.

He came to Minnesota in 1881. After graduating from Gustavus Adolphus College in 1895 he studied law and was admitted to the bar two years later. He served as deputy clerk of the United States circuit and district courts 1897–1906, and as United States commissioner for the district of Minnesota for the same period. In 1903 he was elected State senator and re-elected in 1905. He was elected lieutenant-governor in 1906 and re-elected in 1908. Upon the death of Gov. John A. Johnson in 1909 he succeeded him as governor by virtue of his office. At the expiration of this term he was elected governor in 1910 and re-elected on 5 Nov. 1912. As governor he has been a consistent advocate of the conservation of the State's natural resources, consolidation of the rural schools and of many social and economic reforms.

EBERLE, ā'bĕr-le, **Robert,** German artist: b. Meersburg, 22 July 1815; d. Eberfing, near Munich, 19 Sept. 1860. He was a pupil of Biderman and later of Van de Velde. His talent was particularly displayed in painting sheep. One of his works, 'A Shepherdess,' is in the Modern Gallery, Munich.

EBERLEIN, Gustav, German sculptor: b. Spiekershausen, Hanover, 1847. His chief work is a long frieze ornamenting the façade of the Ministry of Cults, Berlin, with 50 figures attending religion. He did other decorative work for the University of Kiel. Among his works are 'Drawing out a Thorn'; 'Greek Flute Player'; 'Psyche' and the 'Archer.' From his hand also are five allegorical groups at Stuttgart, and monuments of William I at Elberfeld, Geisslingen, Mannheim, Altona and Ruhrort, of Frederick I and Frederick William III in Berlin, of Bismarck at Krefeld, Wagner in Berlin and Goethe in Rome. He is the author of 'Aus Eines Bildners Seelenleben, Plastik, Materie unde Poesie' (1892).

EBERS, ā'bĕrs, **Emil,** German genre painter: b. Breslau, 14 Dec. 1807; d. Beuthen, 1884. He studied at the Academy of Düsseldorf and early turned his attention to dramatic subjects such as scenes of battle in the Middle Ages, brigandage, sailors, fishermen, etc. In later years, after traveling much and visiting the shores of the North Sea, Holland and Normandy, he devoted himself to marine painting exclusively. Among his works are 'Smugglers About to Land' (1830), in the National Gallery, Berlin; 'Fisherman's Hut' (1831); 'Smugglers Surprised' (1832); 'Smugglers in Tavern' (1835); 'Repressing Revolt'; 'Dutch Smugglers on the Coast of Normandy' (1842); 'Prussian Hussars Maltreating French Peasants' (1843); 'Life Boat' (1844); 'Pilot Boat' (1845); 'Storm on Inland Sea' (1845); 'Mutiny on Brig' (1848); and some historical paintings, such as 'Saint Goar converting the Rhine Provinces.'

EBERS, Georg Moritz, German Egyptologist and novelist: b. Berlin, 1 March 1837; d. Tutzing, Bavaria, 7 Aug. 1898. About 1859 he began to devote himself almost exclusively to Egyptological studies, and in 1869 was appointed extraordinary professor of language, history and antiquities of ancient Egypt at Jena. In the following year he traveled in Egypt, Nubia and Arabia, and on his return in 1870 became ordinary professor of Egyptology at Leipzig. Another visit to Egypt in 1872–73 resulted in the discovery of the important medical papyrus known by his name, now in Leipzig, and of which a facsimile was published in 1875. Among his published contributions to Egyptology are 'Disquisitiones de Dynastia vicesima sexta Regum Ægyptorum' (1865); 'Ägypten und die Bücher Moses' (1868); 'Durch Gosen zum Sinai' (1872); 'Papyrus Ebers' (1875); 'Eine Galerie antiker Portraits' (1889); 'Die hieroglyphischen Schriftzeichen der Ägypter (1890); and 'Ägypten in Bild und Wort' (1878–79), translated into English as 'Egypt, Descriptive, Historical and Picturesque' (1880). Besides these works he published many novels, mostly dealing with Egyptological subjects, among which are 'Eine Ägyptische Königstochter' ('An Egyptian Princess' 1864); 'Uarda' (1877); 'Homo Sum' (1878); 'Die Schwestern' ('The Sisters' 1880); 'Der Kaiser' (1881); 'Serapis' (1885); 'Josua' (1889); 'Per Aspera' (1892); 'Kleopatra' (1894) and 'Arachne' (1897). He also published a poem called 'Elison' (1888), and an autobiography (1892), entitled 'Die Geschichte meines Lebens.' A collected edition of his works in 25 volumes was published at Stuttgart (1893–97).

EBERSWALDE, ā-bĕrz-väl'de (ancient NEUSTADT-EBERSWALDE), Germany, town on the Finow Canal, about 28 miles northeast of Berlin. It is a busy industrial centre, having a number of machine-shops, sawmills, car and locomotive works, and doing a considerable trade in lumber and coal. The paper for the notes of the Imperial Bank is here manufactured and there is a royal academy of forestry. Eberswalde, set in a finely wooded district, is a favorite summer resort for the people of Berlin. Pop. 26,064.

EBERT, ā'bĕrt, **Karl Egon,** Austrian poet and dramatist: b. Prague, 5 June 1801; d. there, 4 Oct. 1882. He began with dramas of Bohemian history, many of which were staged but only one printed, 'Wratislav and Jutta' (1835). As a lyric poet and balladist he was more successful; his 'Poems' (1824) contain fine lyrics, and 'Schwerting the Saxon Duke' is still high in popular favor. His longer poems — 'Wlasta, ein bömisch-nationales Heldengedicht in drei Büchern' and 'Das Kloster' are fluent in style as well as pure and elegant in language. 'Ein Denkmal für Karl Egon, Fürsten von Fürstenberg' (1885), consists of a garland of sonnets; 'Fromme Gedanken eines weltlichen Maime' (1859) is a diactic poem.

EBERTH, ā'bert, **Karl Josef,** German anatomist and bacteriologist: b. Würzburg, 1835. He was educated at the University of Würzburg; was appointed to the chair of pathological anatomy at Zürich in 1865, and to a similar chair at Halle in 1881. The results of his anatomical researches, including 'Ueber den Peitschenwurm' (1859) and 'Ueber Nematoden' (1863), appeared in Virchow's *Archiv für pathologische Anatomie.* His bacteriological investigations were chiefly concerned with the bacillus of typhoid. He published 'Die Untersuchung des Answurfs, auf Tuberkelbazillen' (1891); 'Die Thrombose,' with Schimmelbusch (1888); 'Mikroskopischer Technik' (1900).

EBIONITES, ē'bī-ôn-īts, a sect composed of Jewish believers in Jesus of Nazareth as being the Christ or Messiah, who nevertheless retained many of the practices and beliefs of their

ancestral religion. Their name, Ebionites, seems to be formed from the Hebrew word *ebionim*, poor folk; but some of the ancient writers, unacquainted with the history of the primitive church of Jerusalem and Judea and with the Hebrew language, derive the name from that of a supposititious heresiarch Ebion. If the name was originally *ebionim*, "the poor," the sect will have chosen for itself in effect the same name as the mediæval sect of the Poor Men of Lyons. The Ebionites are by many authors confounded with the Nazarenes or Nazarites, another body of Christians Jewish by race and in a measure also Jewish in religion. The rise of the Ebionite sect is commonly referred to the time of Trajan, when, the whole Jewish race being excluded from Ælia Capitolina (as Jerusalem was named anew), these people, despised alike by Jews, Christians and pagan Romans, migrated to Peræa, the country beyond the Jordan, and there freely developed their religious tenets and practices. They were Jewish rigorists, zealots, with some tinge of Christian belief, in that they held Jesus to have been the Messiah; but they held him to be only man and begotten like other men. The Mosaic law they believed to be of everlasting obligation upon all believers in Jesus Christ whether of Jewish or Gentile race. Saint Paul they regarded as a traitor and arch-apostate for his having declared Mosaism superseded by the law of Christ. Of the Christian sacred books they held the Hebrew gospel of Saint Matthew to be the only one given through Divine inspiration.

EBLIS, or FATHER OF DEVILS, in Arabian mythology, the ruler of the evil genii or fallen angels. Before his fall he was called Azazel or Hharis. When Adam was created, God commanded all the angels to worship him; but Eblis replied: "Me thou hast created of smokeless fire, and shall I reverence a creature made of dust?" God was very angry at this insolent answer, and turned the disobedient angel into a Sheytân (devil), and he became the father of devils. He is described as of enormous size, with a red-striped skin, a ring-pierced nose, long hair, large flapping ears and a very long tail. See DEVIL.

EBNER-ESCHENBACH, āb'nĕr ĕsh'ĕn-bāH, **Barones Marie von,** Austrian author: b. (COUNTESS DUBSKY) Castle Zdislavic, Moravia, 13 Sept. 1830. In 1848 she was married to an officer of the Austrian army. Her whole life was spent between Castle Zdislavic and Vienna. Her early products were dramas long since forgotten. She began in 1860 as a playwright with 'Mary Stuart in Scotland' (1860), and the tragedy 'Marie Roland,' with the one-act dramas 'Doctor Ritter,' 'Violets,' and 'The Disconsolate One,' all of which were but moderately successful. Her fiction beginning with 'The Princess of Banalia' (1872), a satiric tale, made little impression; but 'Two Countesses' (1885), a story of Austrian high society, met with striking favor. Her other writings include 'Tales of Village and Castle'; 'The Child of the Parish' (1887); 'The Rival'; 'Aphorisms' (1880); and 'Parables, Stories and Poems' (1892); 'Margarete' (1891); 'Drei Novellen' (1892); 'Glaubenslos' (1893); 'Das Schädliche' and 'Die Totenwacht' (1894); 'Rittmeister Brand' and 'Bertram Vogelweid' (1896); 'Alte Schule' (1897); 'Aus Spathersbttagen' (1901); 'Agave' (1903); 'Die arme Kleine' (1904); 'Die unsiegbare Macht' (1905); 'Meine Kinderjahre' (1906); 'Ein Buch Für die Jugend' (1907); 'Volksbuch' (1909); 'Altweibersommer' (1909); 'Genrebilder' (1910). Her collected works were published in 1893–1911. She is a writer with a remarkably polished style, marked with wonderful powers of description and a facility in character delineation equal to the best. Her plots are well woven and the proportion is just. For her biography, consult Necker (Berlin 1900) and Bettelheim (ib. 1900).

EBONITE. See VULCANITE.

EBONY. See DIOSPYROS.

EBORACUM, ē-bŏr'ą-kŭm, the Latin name of York. See YORK.

EBRO, ā'brō (Lat. *Iberus*), a river in Spain, once the boundary between the territory of Rome and Carthage, has its source in the province of Santander, 10 miles west by north of Reynosa. Pursuing a southeast course of about 500 miles, it flows into the Mediterranean by two mouths. It is navigable for boats up to Tudela, about 180 miles from its mouth, but is obstructed by shoals and rapids, to avoid which a canal, about 100 miles long, has been constructed south of and nearly parallel to the river.

EBULLITION, ĕb-ŭ-lĭsh'ŏn, the bubbling up or agitation which results from the action of heat on a liquid. The escape of vapor from water depends not merely upon the temperature, but upon the presence of gases and other bodies, upon the vessel, and a variety of circumstances, so that a strict definition is necessary. The usual statement is that ebullition is the conversion of a liquid into a vapor or gas having the same tension or elastic force as the air. This conversion takes place at different temperatures for different substances, but it is so constant for each substance that the fixity of the boiling-point of a fluid is regarded as a very good test of its purity. In determining what that point is, it is of course necessary to ascertain what the atmospheric pressure is, to see that it does not vary during the experiment, and to fix upon some standard pressure for comparison of results. The pressure is estimated by the barometer. It is possible to heat water 20° F. above its boiling point without ebullition. See HEAT.

EÇA DE QUEIROZ, ā'sā-dā-kā'rōs, **José Maria,** Portuguese novelist: b. Póvoa do Varzim, 25 Nov. 1845; d. Neuilly, France, September 1900. At first a journalist, he traveled and was in the consular service at Havana, Newcastle, Bristol and Paris. He introduced the naturalistic school into Portugal. His powers of observation and description are extensive, and in his novels — 'The Crime of Father Amaro' (1874, rewritten in 1880); 'The First Monk of Saint Basil' (1877); 'A Relic' (1886) — he portrays in master strokes the failings of Portuguese society. His strange, half realistic, half fanciful story, 'The Relic,' weaves into a narrative of Oriental travel a dramatic representation of the Passion of Christ in the form of a dream. In collaboration with Ramalho-Ortigão he wrote the spirited tale of adventure, 'The Mystery of Cintra Street.' Several of

his works have been translated into English by Edgar Prestage.

ÉCARTÉ, ā"kär-tā', from the French, meaning discard, a game at cards for two persons. The game is played with a piquet pack, that is 32 cards, the small cards, from 2 to 6, being excluded. For convenience of dealing, two packs are generally used. The players cut for the deal; the lowest card (in France the highest) deals. The dealer gives 5 cards to each player, 3 and 2 at a time, and turns up the 11th card as trump (French, *atout*). If the turn-up is a king the dealer scores 1, and if a king turns up in the hand of either player the holder may score 1, but in each case this must be announced before the first trick by saying, "I mark king." The king is the highest card, the queen next, then knave, ace, 10, etc. Trump takes all other suits. The non-dealer leads, if satisfied with his hand. If not, he proposes, i.e., he states that he wishes to exchange some of his cards for new ones in the stack. The dealer may or may not accept the proposal. If he does, each one discards as many cards as he chooses and takes fresh ones, the non-dealer receiving them first. This may continue until the non-dealer is satisfied. After the non-dealer had led the other player must follow suit, and take the trick if he can; if he cannot follow suit, he must play trump, if he holds one. The winner of the trick leads again till the 5 tricks are exhausted. Three tricks count 1 point, 5 tricks 2 points. Five points make a game. The player, according to the French game, must announce the suit he plays, and if he plays differently, can be compelled to play as he announces, or if he cannot, as his adversary pleases. If the non-dealer fails to score 3 tricks, the dealer scores 2. The rules of the game are varied in different countries. Pool écarté is played by more than two players; the extra player serving in the capacity of adviser and replacing the loser in turn, until one player wins two or three successive games. The loser must always leave the game, unless he has guaranteed to take all bets, which is called playing "la chouette."

ECBATANA, the ancient metropolis of Media, built by Seleucus. It was the summer residence of the Persian and Median kings and existed in great splendor at a very early period in the history of the world. There are no traces now remaining of the site of this once celebrated city. Herodotus (I, 90), and Polybius (X, 20) are the main sources of information attesting its magnificence. In the absence of excavations, these must be regarded as authentic. The city was built on a hill, on top of which was a splendid temple of the sun. Seven concentric walls circumscribed the city,—the innermost of gold,—the next of silver, the next orange, blue, scarlet, black and white, respectively. The stronghold and the palace were richly ornamented and carved. It fell successively into the hands of Alexander, the Seleucidæ, and Antiochus the Great. Finally the Parthians gained possession of it, and it gradually diminished in splendor. The present Hamadan is generally conceived by scholars to have been the original site of the city. Consult De Meynard, B., 'Dictionnaire géographique de la Perse' (Paris 1861); Crawshay-Williams, 'Across Persia' (New York 1907).

ECCE HOMO, ĕk'ē hō'mō ("Behold the Man"), the rendering, in the Latin Vulgate, of the words with which Pilate presented Christ, in scarlet robe and crowned with thorns, to the populace. The figure of Christ in this scene is the subject of a celebrated painting by Correggio which is preserved in the National Gallery of Painting in London. Other great painters have chosen the same subject, among them Guido Reni, whose 'Ecce Homo' is in the picture gallery of Dresden; Titian, in the Scuola di San Rocco, Venice; Souonia, in the Petti Palace, Florence, and Tintoretta, in the Munich Gallery.

ECCENTRIC, or ECCENTRIC CIRCLE, in ancient astronomy a circle whose centre was supposed to be displaced from the centre of motion. It was a makeshift to try to account for the motions of the planets before Kepler's discovery of their true motion in ellipses with the centre of attraction at one of the foci of the ellipse. Also, in mechanics, a term applied to contrivances for converting circular into reciprocating rectilinear motion, consisting of variously shaped disks attached to a revolving shaft.

ECCENTRICITY, deviation from a center; the state of a circle with respect to the non-coincidence of its centre with that of another circle. The eccentricity of an ellipse is the fractional quotient (always less than unity), which is obtained by dividing the distance from the focus of the curve to its center by the half length of its greater axis. The greater the eccentricity is, the longer the curve becomes in proportion to its width: as the eccentricity diminishes the form of the curve approaches that of a circle: the eccentricity of the circle is zero. The eccentricity is one of the most important of the so-called "Elements" of the orbits of the planets and of the double-star systems.

ECCHYMOSIS, ĕk-ĭ-mō'sis, a subcutaneous hemorrhage due either to bruising or some form of external injury, or occasionally the result of a peculiar blood disease hæmophilia. Ecchymoses usually result in varying grades of discoloration, and are best treated by means of hot water, locally applied.

ECCLEFECHAN, ĕk-l-fĕʜ'ăn, Scotland, village of Dumfriesshire, near the main line of the Caledonian Railroad, 20 miles northwest of Carlisle. It is the birth- and burial-place of Thomas Carlyle, and is unmistakably the "Entepfuhl" of his famous spiritual autobiography, 'Sartor Resartus.' The house in which he was born, 4 Dec. 1795, still stands, and in the west corner of the churchyard around the United Presbyterian church, which represents the old Secession church, he was laid, as he wished to be, beside his father and mother. Pop. 670.

ECCLES, Robert Gibson, American chemist: b. Scotland, 1 Jan. 1848. He came to the United States in 1862 and became chemist in the Bureau of Indian Affairs and professor and dean in the Brooklyn College of Pharmacy. He has discovered calycanthic acid and the alkaloids calycanthine, glaucosine, etc., and devised the official method of assaying pepsin and investigated the effects of drugs on peptic digestion. He also exposed numerous fraudulent medicines, among them the Scotch oats essence.

He has written more than 100 articles on philosophic and scientific subjects, including 'Food Preservatives' (1905); 'Darwinism and Diabetes' (1908); 'Letters from Foreign Lands' (1908); 'Darwinism and Malaria' (1909); 'Parasitism and Natural Selection' (1909); 'Touring the Lands where Medical Science Evolved' (1909); 'Darwinism and Anaphylaxis' (1911).

ECCLES, England, a municipal borough in Lancashire, four miles west of Manchester, of which it is a suburb. There are here numerous cotton-mills. Pop. 41,944.

ECCLESFIELD, England, a parish in the West Riding of Yorkshire, six miles north of Sheffield. The chief manufacture is cutlery, then flax, linen, paper and nails; while in the vicinity there are coal and iron mines. Pop. 22,404.

ECCLESIA ("convocation"), a popular assembly, especially that of Athens, where the people exercised full sovereignty and at which every citizen of 20 years of age was entitled to vote. In early times, the ecclesia met once in each prytanig, a period of 35 days, into which the year was divided. Later they met four times during that period. They were called by the prytanes and presided over by the epistates. Later they were governed by a committee of nine. The people voted either by show of hands or occasionally by ballot, the latter method being by white and black pebbles. Besides the legislative powers of the assembly, it could make inquisition into the conduct of magistrates, and in turbulent and excited times exercised a power resembling that of impeachment, as in the cases of Demosthenes and Phocion. The assembly was sometimes suddenly broken up at the occurrence of an unfavorable omen, as thunder and lightning, sudden rain or any unusual natural phenomenon. During the 5th and 4th centuries they met at the Pnyx, and after the 3d century at the market place or theatre. In Sparta, all the citizens in possession of full civic rights were entitled to take part in the deliberations of the assembly from their 30th year onwards. It was convoked once a month at the full moon. Its business was to accept or reject proposals made by the senate. It made its will known by acclamation or by separation and actual counting of the parties. The right of bringing forward proposals and speaking in the debates was reserved to the kings, the ephors and the senators. The assembly elected the officials and senators to decide on the regal succession, on war and peace, treaties, legislation, etc. The term was also applied to any group acknowledging Christ as their Saviour and Lord. The word thence was adopted by the New Testament writers to designate "church."

ECCLESIASTES. One of the books of the Old Testament. The title in the Greek Bible, transliterated in the Latin and some modern versions, is a rendering of the Hebrew Qoheleth. Plato ('Gorgias,' 452 E) and Aristotle ('Politics,' iii, 1) use the term for "a member of the assembly." The Hebrew word is a feminine participle in the simple stem of a denominative verb derived from *qahal,* "assembly." It occurs nowhere else than in this book, and in the present text is clearly a designation of Solomon, probably invented by the author on the basis of 1 Kings viii, 1ff, where the king assembles the elders of Israel and addresses them (according to 2 Chronicles vi, 13 from a specially constructed brazen scaffold), to describe the wise monarch on whose lips he places his diatribe as the orator *par excellence.* Luther's translation "Der Prediger" and the English alternate title "The Preacher" have a somewhat different connotation. Less probable are the views that the word indicates "collector of wisdom, theoretical and practical" (Rashi, Ibn Ezra, Ibn Ghiyyat, Tanchum), or "collector of the opinions of the wise" (Grotius), or "gatherer of an assembly of sages" (Jepheth ben Ali, Delitzsch); or that "wisdom" is understood as the speaker (Græcus Venetus, Baruch ibn Baruch, Ewald, Hitzig, Kleinert, Derenbourg); or that the title means "popular sayings," or "words intended for public use" (Kamenetzky).

In the Hebrew manuscripts and printed editions Ecclesiastes is one of the five *megilloth,* or "rolls," and is placed between Lamentations and Esther. This position is probably not much older than the 12th century when it apparently began to be read at the feast of tabernacles. In the Talmud 'Baba bathra' 14b, 15a, the five rolls are not put together, and in the Greek Bible the book follows Proverbs and precedes Canticles, an order that has been adhered to in the later versions. When it was first read in the synagogue as "Scripture" is not known. That it was quoted as such by Simon ben Shetach in the reign of Alexander Jannæus, by Baba ben Buta in the time of Herod, and by Gamaliel I is vouched for only by late and scarcely reliable testimony (Pal. Talmud 'Berakoth' vii, 2; Bab. Talmud 'Baba bathra' 4a). Questions as to its canonicity arose in connection with the Pharisaic innovation of washing the hands after contact with sacred books. The school of Shammai held that it did not defile the hands, consequently was uncanonical, while the school of Hillel maintained that it did. The council of Jamnia, c. 90 A.D., was in doubt, but the majority seems to have admitted its canonicity; yet a century later Jehuda ha-nasi declared: "Qoheleth is disputed" (Mishna 'Yadaim' iii, 1; 'Eduyoth' v, 3).

The critical apparatus by which it is generally possible to restore, at least tentatively, the original text of a biblical book is, in the case of Ecclesiastes, regrettably limited. It has been seriously questioned whether a Greek translation existed before the 2d century A.D. Following a suggestion of Freudenthal, Grätz reached the conclusion that the version in our manuscripts was made by Aquila, and this view was accepted by Renan and König. Dillmann maintained that the original Greek text had only been worked over by the aid of Aquila's, and this was also the opinion of Klostermann. But McNeile has convincingly shown the improbability of this theory. Since Jerome refers to two editions of Aquila's version, he assumes that the text in our manuscripts is the first of these and that Origen inserted it in the column devoted to the so called Septuagint, because the Alexandrian version did not contain this book, while the second edition was placed in the Aquila column. These conclusions have been adopted by Barton. Swete ('Introduction to the Old Testament in Greek,' 1900) and Reider assign the present text to "the school of Aquila."

Since the Syro-Hexaplaric version represents our Greek text, there can be no doubt that it essentially goes back to Origen, and the problem is how this critic, who must have recognized «the school» as quickly as the master, could have substituted it for the Alexandrian version, if one was known to him, or in any case how he could have been silent about the matter. An earlier version might conceivably have been lost, as has that on which Theodotion's recension is supposed by many scholars to be based. If the author of Wisdom of Solomon ii, 1–9, whether he lived in the 1st century B.C. or at the time of Caligula, really undertook to correct certain sayings of Ecclesiastes or misinterpretations of their trend, as appears probable, it is likely that he had before him a Greek translation, and it is not inconceivable that Aquila may have used it to some extent in his first edition, before he began to apply his principles more rigorously. Unfortunately, there are no quotations of the book in Philo, Josephus or the New Testament, and few in early patristic literature. It is thought that the fragments from the Aquila column represent Akiba's recension of the Hebrew text, while the first edition of Aquila may have preserved readings of a pre-Akiban text. Among the early versions, the Syriac Peshita and the Latin Vulgate are derived directly from the Hebrew; the Old Latin, Sahidic, Arabic, Armenian, and Slavonic are translations of the Greek text. In the Sahidic, ix, 4–x, 3 is lacking, probably because this section did not harmonize with the prevailing ascetic sentiment among Coptic Christians. Of the Syriac version, made from the Greek by Paul of Tella, a photolithographic reproduction was published by Ceriani in 1874. The integrity of the book was not questioned by those who in earlier times were struck by its apparent contradictions and conflicting sentiments. Pope Gregory I and many mediæval writers assumed that thoughts not approved by the author were given expression only to be corrected, so that the work had something of the nature of a dialogue. This interpretation was naturally favored by scholars who understood the title as designating a «collector.» When the difficulty of ascribing the book to Solomon began to be realized, speculation increased as to the origin of the sentiments introduced to be corrected. If already Jerome, Gregory I, and Bar Hebræus had suggested a similarity to Epicurus, Empedocles, Aristippus, and the Cyrenaic philosophers, Luther thought of actual extracts from writers in the library of Ptolemy III Euergetes in Alexandria: Grotius apparently had Oriental philosophers in mind; Yeard supposed the book to be a dialogue between a sensual worldling and a God-fearing Jew; Herder heard two voices in it, one of a somewhat audacious seeker, and another of a teacher who sets him right; Bergst found in it a dialogue between a modern Qoheleth who had become a Greek sophist and an orthodox teacher represented by Solomon; and Bertholdt adopted a similar view. This tendency inevitably led to a denial of the unity of the book. Van Limburg-Bouwer believed that two different works were united by an editor who interpolated the original with long excerpts from another document written by a sceptic. In addition to the idea of dislocations, already put forth by Van der Palm in 1784, Bickell and Haupt also accepted the theory of interpolations on a large scale, but supposed the sceptic to be the original author. Bickell's notion of dislocated leaves has been shown to be archæologically untenable, and although Haupt's view is not subject to the same objections and the book of Ecclesiasticus reveals the possibility of such dislocations, it is not easy for even the most ingeniously and tastefully arranged anthology to win recognition as a reliable reconstruction of a lost original. Siegfried supposed that the original book was interpolated by an Epicurean Sadducee, a pious Chasid, a wisdom-teacher, and at least three others. While Dillon and Lauer have adopted this analysis, it has been modified by McNeile who assumes that the book was edited by an admirer employing the guise of Solomon, and interpolated by the annotations and criticisms of two contemporary thinkers, one adding more or less isolated apophthegms bearing on life and nature, another a pious Jew following the calm and untroubled path of religious conviction, and substantially the same position has been taken by Barton, though he somewhat reduces the number of interpolations. On the other hand, Kuiper found it unnecessary to remove gnomic sayings that did not contradict the thought of the original author. Proceeding on the assumption that the bulk of the book constitutes the commentary of a later writer on a collection of popular proverbs, Kamenetzky tentatively sought to restore this collection, including i-iii and single verses in the later chapters.

That the epilogue, xii, 9–14, is a later addition to the book has been maintained by Doederlein, J. E. C. Schmidt, Bertholdt, Umbreit, Knobel, Hitzig, Kleinert, Krochmal, Grätz, Bloch, Vatke, Renan, Van Limburg-Bouwer, Bickell, Cheyne, Smend, Schmidt, Baudissin, Haupt, McNeile, Barton, Budde, Bennett, Gunkel, Driver, Sellin, Gigot, and others, and although such scholars as De Wette, Bleek, Ewald, Herzfeld, Rosenmüller, Kuenen, Cornill, Tyler, Genung, Wright, Condamin, and Zapletal have sought to explain these verses by an intentional dropping of the Solomonic mask, their secondary character is highly probable. It does not necessarily follow, however, that all passages in the book referring to the fear of God and retribution, or all proverbial sayings interspersed in the text must be regarded as interpolations. The analogy of other biblical books renders it indeed altogether likely that there are editorial additions, glosses, and interpolations. Even in xi, 7–xii, 7, regarded by Schmidt on account of its highly poetical character as a song quoted by the author, xi, 8b, 9b; xii, 1, 2a, seem to be additions, both on metrical grounds and for reasons already suggested by Luzzato, Geiger, Grätz and Bloch. But whatever his views of the divine being may have been, the author was obviously still a theist. A wholesome fear of natural consequences is not of necessity connected with a definite scheme of retribution, either here or hereafter. An essentially sombre, disillusioned, and fatalistic outlook upon life is not incompatible either with the earnest search for some fruit of human labor or an emphasis on the value of work and moderate enjoyment. It is not necessary to assume, with Margoliouth, that the author, like Abu'l Ala al Maarri, re-

sorted to a sprinkling of pious utterances to conceal his heresy. It would be natural for a Hebrew sage, particularly if he wrote in the name of Solomon, to indulge his taste for quoting wise saws, even if they fitted loosely in the context, and to give to some sayings a subtle turn. Aside from the epilogue and a limited number of glosses in the text, Ecclesiastes is probably the work of one author, who, however, quoted some songs and sayings of others.

According to Jewish and Christian tradition the book was written by Solomon. The Talmudic statement ('Baba bathra' 15a) that the men of Hezekiah wrote it, probably suggests only some kind of editorial activity. Even the heretics mentioned by Philastrius of Brescia, Theodore of Mopsuestia, who was condemned by the Fifth Ecumenic Council for failing to recognize its divine inspiration, and Abu'l Faraj Bar Hebræus, who held a similar view, did not doubt the Solomonic authorship. This was apparently first done by Luther ('Vorrede auf die Bücher Salomonis' 1524; 'Tischreden' IV, 400); Grotius (1644); Le Clerc (1685); Von der Hardt (1716); Lowth (1753); Voltaire (1759; 1769); Gibbon ('Decline and Fall of the Roman Empire' c. xli; 1776–88); Eichhorn (1779); Herder (1780); Doederlein (1784); Zirkel (1792); J. Jahn (1793); J. E. C. Schmidt (1794); Nachtigall (1798); Bergst (1799); Bertholdt (1815); Umbreit (1818); Rosenmüller (1830); Köster (1831); Knobel (1836); Ewald (1837); Herbst (1840); Hitzig (1847), and a host of later interpreters, including conservative Protestants like Hengstenberg, Vaihinger, Hävernick, Keil, Stuart, Zoeckler, Cox, and Wright; Jewish scholars like Geiger, Luzzato, Grätz, Herzfeld, Seinecke, and Derenbourg, and such Catholic interpreters as Zirkel, Jahn, Herbst, Movers, Cardinal Newman, Veith, Kaulen, Bickell, Grimme, Loisy, Von Hügel, Zenner, Durand, Prat, Zapletal, Gigot, and Peters. The traditional view has been recently defended by Wordsworth, Milman, Glaire, Pusey, Wangemann, Hahn, Böhl, Bullock, Schäfer, Von Essen, Lesètre, Gietmann, and Cornely, but on insufficient grounds.

It has been urged against the traditional view that the pretended Solomon says: "I was king over Israel in Jerusalem" (i, 12), "I have gotten me great wisdom above all that were before me over Jerusalem" (i, 16), and "I was great and increased more than all that were before me in Jerusalem" (ii, 9); that he complains of wickedness in the place of judgment (iii, 16), oppression with no comforter (iv, 1), tyranny and corruption of judges (v, 8; vii, 7), and the dangers of espionage (x, 20); and that there is no sign of repentance or warning against idolatry. In view of Ps. lxxxviii, 4 it is quite possible that we should translate "I, Qoheleth, am king over Israel in Jerusalem," though Solomon himself would certainly not have used the verb at all any more than the form of the pronoun employed. There would be no impropriety in Solomon mentioning his capital. Nor would there be any psychological improbability in a reference by Solomon to his great wealth and wisdom, so much admired by the Queen of Sheba, or his comparing himself with former kings in Jerusalem of whom we are beginning to learn something, even though Jerome observes that it is not greatly to his glory that he boasts his superiority over his father. It is not clear why a wise king should have hesitated to express his sympathy with the poor and oppressed, and his indignation at the corruption of judges,, or should have failed to recognize the limitations of royal power to alleviate social distress and prevent such insurrections as troubled his reign. There is no evidence that Solomon repented of his sins or regarded his polygamy and worship of other gods as sins. The Chronicler, who made other kings repent, left out of his record the deeds of Solomon of which he disapproved. The most important arguments against the Solomonic authorship have been derived from the language, style, and thought of the book. It is not merely the vocabulary, with its Persian and Aramaic words, and Hebrew terms occurring as a rule only in post-Christian times, but the regular use of the shorter relative, the form of pronouns, prepositions and conjunctions, the abandonment of the characteristic *waw* consecutive, in general the deteriorated syntax and the cumbrous construction of sentences clearly point to the latest stage of biblical Hebrew. This development has obviously advanced beyond that found in Daniel, Chronicles and Esther. Neither the Hebrew of Ecclesiasticus nor that of the Zadokite documents (c. 100 B.C.) reveal so much affinity with the language of the Mishna. Even when the difference of subject matter is duly considered, the style is widely removed from that of the Law and the Prophets, and there is a marked change even from that of such late books as Job and Proverbs.

With some scholars one of the determining factors in assigning a very late date has been the assumed influence of Greek thought in general, or specifically that of some of the philosophical schools. Such an influence seems to have been felt by Luther. Zirkel pointed out what seemed to him translations of Greek phrases, and in the case of some of these he was probably right. Especially Tyler and Plumptre have endeavored to show the presence of ideas peculiar to the Peripatetic, Stoic, and Epicurean schools, and Ed. Pfleiderer that of Heraclitian conceptions. The objection that some notions equally or more characteristic of these schools are absent, or that a somewhat strained interpretation has now and then been resorted to, is not altogether sufficient to offset the impression of their arguments. A certain eclecticism is to be expected; a grafting of new ideas on a traditional conception of life is unmistakable, and the author can scarcely be regarded as a logical thinker. Havet called attention to some striking similarities between passages in Ecclesiastes and the Festal Dirge ascribed to a king of the 11th dynasty, published by Goodwin ('Records of the Past,' 1st series, iv, 115ff) and the Song of the Harper from the 18th dynasty, published by Stern (id. vi, 127ff), and Grimme noted the analogy of sentiment and language to a cuneiform document of the Hammurapi period, published by Meissner ('Mitteilungen der Vorderasiatischen Gesellschaft,' 1902), quoted also by Barton to show that Ecclesiastes developed motives early extant in Semitic thought. But such expressions of sentiments common not only to Semites and Egyptians but to men of all lands and ages in certain moods do not constitute the most significant points indicated by Tyler and Plumptre. Dillon

finds analogies to Buddhist ideas; but Margoliouth rightly queries why there should have been so little of this, if there had been any knowledge at all of the congenial thought of India. The moderate view of Kuenen, Kleinert, Cornill, and Cheyne, who find a general acquaintance with Greek ideas that were in the air in the Hellenistic age rather than an attachment to a particular school, seems to commend itself.

The text of the book has been closely scrutinized for possible historical references that might throw light upon the real author and his time. Luther thought of Sirach as the author, Grotius of Zerubbabel, Von der Hardt of Joshua ben Joiada, Leimdörfer of Simon ben Shetach, Winckler of Alcimus and Grimme of Jehoiachin. But this search for his name is an unprofitable «chasing after wind.» Hitzig saw in iv, 13ff; x, 16f allusions to Ptolemy IV and Ptolemy V; Grätz to Herod the Great and his son Alexander; Winckler to Antiochus IV and Demetrius I; Haupt to Antiochus IV and Alexander Balas; Barton to Ptolemy IV, Ptolemy V and Antiochus III (so already Böttcher, 'Neue Aehrenlese,' 1865). Haupt's conjecture is most probable. The little city saved by a poor wise man (ix, 14ff) was supposed by Hitzig to be Dor, though the account in Polybius v, 66, would then have to be in important respects supplemented by that of Ecclesiastes. Ewald thought of Athens and Themistocles, Friedländer of Syracuse and Archimedes, though neither of these places could be spoken of as a little city, and neither of these men was soon forgotten. Haupt supposed Bethsura was meant (1 Macc., vi, 31ff; 2 Macc., xiii, 19f). This is not improbable, though in that case also the remark of Ecclesiastes that «no one remembered that poor man» would be justified by the silence of the historians. While many scholars in the early part of the 19th century assigned the book to the Persian period, the great majority in recent times have reached the conclusion that it must have been written about 200 B.C. Zirkel, Renan, Kleinert, Winckler, Leimdörfer, Haupt, Schmidt, and Peters would descend still another century. To this the objection has been made that Jesus son of Sirach was familiar with Ecclesiastes. But none of the passages that led Nöldeke somewhat hesitatingly to change his former view on this point is at all conclusive, as Peters has shown, and those adduced by others in addition have little weight. Less probability attaches to the conjecture of Grätz, adopted by Havet and Cheyne, that the book was written in the time of Herod the Great. The scruples in regard to oath-taking would be as characteristic of the Essenes in the time of Alexander Jannaeus as later. Ecclesiastes may have written his work c. 100 B.C.

That the book, though substantially written in prose, contains some scraps of poetry was seen by Desvoeux in 1760, and Lowth inclined to the same view in the second edition of his 'Prælectiones,' 1763. Nachtigall attempted to show a strophic structure throughout, and Köster assumed that the entire book was written in the parallelisms characteristic of Hebrew poetry. Ewald returned to the idea that certain parts only had this literary form. Derenbourg supposed that reminiscences of a rich apophthegmatic literature were occasionally interspersed by the author after the fashion of the poetic fragments introduced in their works by Arabic writers; and Renan recognized the metrical character of these insertions and, in rendering them, imitated the style of the ancient quatrains and rhymed proverbs of Marculfe, Pibrac, and Chatonnet. Grimme (*Zeitschrift der Deutschen Morgenländischen Gesellschaft*, 1897) assumed that the whole book (except xii, 13, 14) was written in metrical form. Schmidt (in *The Coming Age*, 1899) maintained that the 'Song of Youth and Age' (xi, 7–xii, 7 except some interpolations) was an elegiac poem in a regular metre quoted by the author. Sievers ('Metrische Studien' 1901) treated i and ii as poetry. Zapletal and, independently, Haupt in 1904 reached the conclusion that practically all parts of the book were written in metric form. The contention of Genung and many other scholars that the work is throughout written in prose can scarcely be maintained. While a large part seems to present to us a prose struggling to free itself from the traditional vehicle of gnomic literature and create an instrument more suitable for philosophical discussion, the marks of poetic diction are unmistakable, not only when the author enriches his work with quotations, but also when he feels the demand of a more elevated style.

Concerning the purpose and character of the book there has been much difference of opinion. Jerome who read it to Blesilla and wrote his commentary at her suggestion regarded it as intended to show the worthlessness of mundane existence and to bring home the need of an eternal life. This was typical of early interpretation. Some mediæval Jewish exegetes recognized in it a serious testing of the foundations of belief and were encouraged by it to philosophical speculation. Luther laid stress on the injunctions to a simple enjoyment of the pleasures of life in the fear of God. But the dominant note of sadness in reflecting upon the transitory and apparently profitless course of man's life and the hopelessness of any future reward could not be missed when the allegorizing tendencies were discarded and the literal sense alone was sought. Hence the impression of a pervading pessimism and scepticism that appealed to Voltaire who regarded it as «un monument précieux» and dedicated his rendering of it in verse to Madame Pompadour and Frederic the Great; to Heinrich Heine who styled it «Das Hohelied der Skepsis»; to Eduard von Hartmann ('Das Lied vom Ewigen,' 1889) who defined it as «ein Brevier des allermodernsten Materialismus und der äussersten Blasirtheit»; and to Renan who called it «un des ouvrages des plus charmants que nous ait legués l'antiquité.» Theologians like De Wette, Knobel, Umbreit, Bruch, and Plumptre emphasized its scepticism. But whatever influence of Greek philosophy or free and fearless speculation may have been felt in the book, the frequent mention of God did not seem to allow the inference that the author had lost completely his childhood's faith. The careful avoidance of the name Yahwe is indeed, as Bergst saw, a sign of a late date, but not of a diminished faith in a living God, as many of the Psalms and Daniel prove. It is important, however, to notice the character of his references to God. A certain resentment against the power of God, checking with apparent jealousy every effort of man, has been discerned by McDonald and others. «At bottom more religious,» says Renan, «the author of Job

is more audacious in his language; Qoheleth has no longer the strength to be indignant at God; it is so useless.» Kleinert observes that the thought of an immanence of the supramundane God in the world and in history, the heroic confidence, the expectation of impending judgment, the imperishable hope, the fervent prayer, the sense of sin and the need of atonement are gone; there are no anthropomorphisms, but neither is there any breath of warm life; the conception of an inscrutable and inexorable omnipotence approaches the lifelessness of Fate.

It is true that the attitude of Ecclesiastes toward death does not differ essentially from that of his ancestors. But the question: «Who knows whether the spirit of the sons of man goes upward and whether the spirit of the beast goes downward to the earth?» seems to show that the somewhat strenuous denials of immortality are made in view of contemporary assertions, probably reflecting foreign speculation, that the spirit does not go down to Sheol, but up into the empyrean. The recognition of a fixed cosmic order does not lead to a discussion of the freedom of the will: good counsel is given on the assumption that, within certain limits, man can determine his own conduct. Against the conception that theoretically Ecclesiastes reaches no other conclusion than that of the essential worthlessness of existence and that, in view of this, he adopts an opportunist hedonism, Genung strongly emphasizes his scientific spirit, advancing by the inductive method in the search for truth, his restraint when confronted with theories still lacking a basis of verifiable fact, his discernment of relative values, and his stress upon character and recognition of the intrinsic importance of work and pleasure. There is much justice in these observations, even if at times they leave the impression of a subtlety that discovers aims and ideas which may not have been present in the author's mind. Struck by the circumstance that in the proto-canonical books «from Genesis to Paul» the fall of man is not mentioned except by Ecclesiastes (vii, 29), McDonald has assigned to this doctrine, which appears to be as casually referred to, if at all, as in Ecclesiasticus xxv, 24, or Wisdom of Solomon ii, 23, 24, a larger place than seems to be warranted by the rest of the book. The value of the poetic insertions has long been recognized. In the Song of Youth and Age with which the work fitly closes, the deep sense of the desirability of life, the intrinsic worth of human existence, adds to the pathos; it touches every heart because it sings the universal fate of man; it is at once a chant of death's advance even in the midst of life and life's affirmation of its joy even in full view of death.

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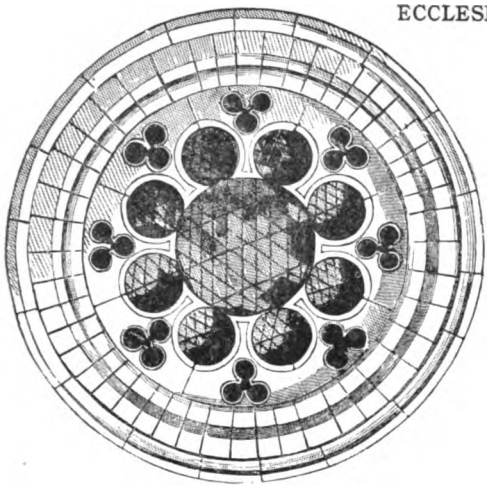
ECCLESIASTICAL ARCHITECTURE. See ARCHITECTURE; BYZANTINE ARCHITECTURE; ROMAN ARCHITECTURE.

ECCLESIASTICAL ART. The science of ecclesiology consists of two entirely distinct

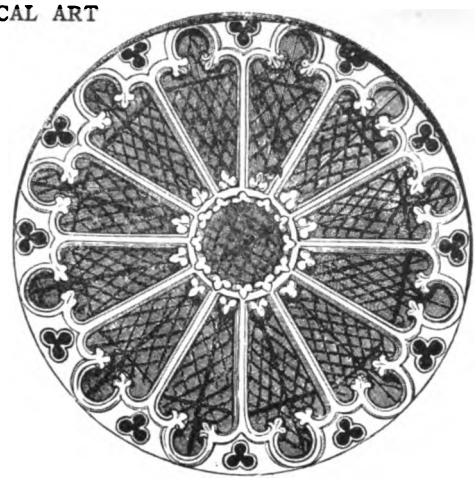
and separate branches of religious work. One of these concerns itself with the organization and development of the Church body, the polity of the Church community, all from the side-point of the clergy or prelates. The second branch of ecclesiology treats of Christian church edifices, the churches' contents, including all that goes into the furnishing of the interior of the building, such as its decoration, everything that pertains to the material or articles used in the religious ceremonies. This article devotes itself entirely to the category of subjects pertaining to the latter branch of ecclesiology. Few writers appear to have attacked this subject as a whole in a monograph. The sculptured mural decorations of the different periods have been expatiated on in works on "Christian Architecture"; the sculptured statuary and bas-reliefs of the world's Christian churches have been written on by laymen and clerics under the title of "Christian Iconography"; the painted mural, altar and other polychrome decoration of Christendom's churches has been treated by works on "Christian Art." Church furniture has found numerous writers to expound the topic of the construction and carved decoration of altars, pulpits, choir-stalls, altar services, embroidered art work on priestly vestments, decorative lighting apparatus, etc. Many of such works are written in a lucid and popular style, devoid of all clerical Latin terms unintelligible to the lay reader. But the works entitled "Christian Art" include in their text and illustrations paintings and sculpture depicting religious subjects created for public buildings other than ecclesiastical, such as courts of justice, city halls, public galleries, etc. As the entire subject of Ecclesiastical Art in its various branches is quite voluminously covered in the volumes of the ENCYCLOPEDIA AMERICANA, this article necessarily avoids long repetitions of such treatments. Articles on the church edifices, their groundplans, façades, etc., will be found under the different specific titles as cross-referenced in the body of the text, such as ARCHITECTURE, ROMANESQUE; BASILICA; BYZANTINE ARCHITECTURE, etc. The same can be said of altars and their furnishing, which are fully discussed under the titles ALTAR; CHALICE; CORONA; CHANDELIER; CROSSES AND CRUCIFIXES; COSTUME, ECCLESIASTICAL; ART ENAMELS, etc.

An exceedingly interesting feature that confronts the student of ecclesiastical art is the fact that practically all art talent of Christendom up to, and perhaps inclusive of, the 14th century was dedicated to the Church. And until the last few years of the Middle Ages all art was either carried on by the Church or under the supervision of the clergy. Much of the early art work was created in the cloisters (manuscript writing and illumination exclusively, of course) by the monastic orders. And under the tutelage and patronage of such prelates as Abbé Suger and Saint Eloi of France, Bishop Bernward of Germany, etc., schools of art were established and the Fine Arts sustained while all the lay world was battling in dynastic and baronial feuds.

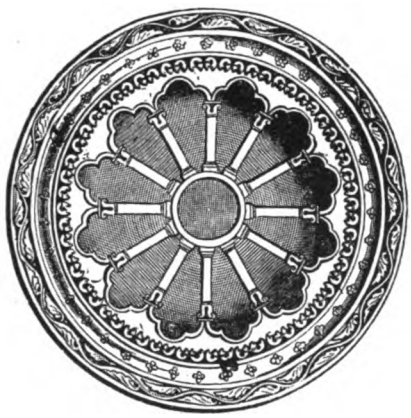
Art of the Catacombs and of the Primitive Christians.—The more distinguished among the early Christian dwellers in Rome received interment in the Catacombs in specially contrived chapels dug out from the sides of the innumerable subterranean passageways of the vast series of excavated galleries then existing. These mortuary chapels usually took as ground plan a Greek cross (+); the roof was scooped out to form a dome or cupola (generally painted over in blue), the entrance of the recess was surmounted by conch-shells, the sides covered with symbols and devices of Christianity. (See SYMBOLISM). In the recessed spaces dug out at the extremity and two sides were placed the sarcophagi of confessors, bishops, martyrs, etc. The sarcophagus at the furthest end was used as an altar or communion table. There are a number of these in the Catacombs of Rome. These subterranean specimens of architecture and the art of the earliest Christian believers remained forgotten for many years after Constantine I was converted and the secret assemblage of the persecuted believers became unnecessary. In 1578, by accident, the presence of these underground passages was discovered by laborers and public interest was excited to investigate these very ancient remains. Antonio Bosio spent 35 years exploring the intricate cavernous labyrinth and making plans of its ramifications and producing copies of sculptures and paintings; the work resulted in the monumental 'Roma sotterranea' (1632). Aringhi (1659) and others continued the work. These acts of devotion preserved to us a view of these interesting works which have since decayed and perished. With the freedom of worship accorded the Christians by Constantine grew up, by the 4th century, three forms of buildings in which to perform religious ceremonies: baptisteries for Christian initiation; churches for the congregations' worship; sepulchral chapels for prayers in commemoration of the "departed." The architectural plan adopted for a building in which the devout could worship was that of the pagan basilica (see BASILICA) with its *atrium* (front court), *narthex* or portico, nave, *cancellum* (choir), *ambone* (pulpit with entrances on both sides), "triumphal arch" (entrance to sanctuary), transept, presbytery (sanctuary), altar, *absis* (tribune) with its bishop's throne (*suggestus*), side aisles. A crypt beneath the sanctuary contained the tomb or shrine of the saint or martyr to whom the church was dedicated. It is frequently claimed by authorities that this crypt was added to the pagan plan of basilica as reminder of the catacomb location of the first Christian church; in fact, a number of the early churches had pretentious subterranean quarters for worship. The steeples were later additions of the Lombard architects about the 8th century, when bells were introduced from Greece. Some writers recognize a resemblance in the early baptisteries to the ancient Roman baths. Mostly they are octagonal buildings. Some claim that the octagon form is symbolic of regeneration; very appropriate for the rite of regeneration by baptism. By early orientation the baptisteries were placed in front of the central entrance to the cathedral; symbolic of the initiation before entrance in the Church (see BAPTISTERY). The font was located in the centre of the building, which was surmounted by a dome. The font was reached by descending three steps to the



Rose-window, 13th Century



Typical 13th Century rose-window



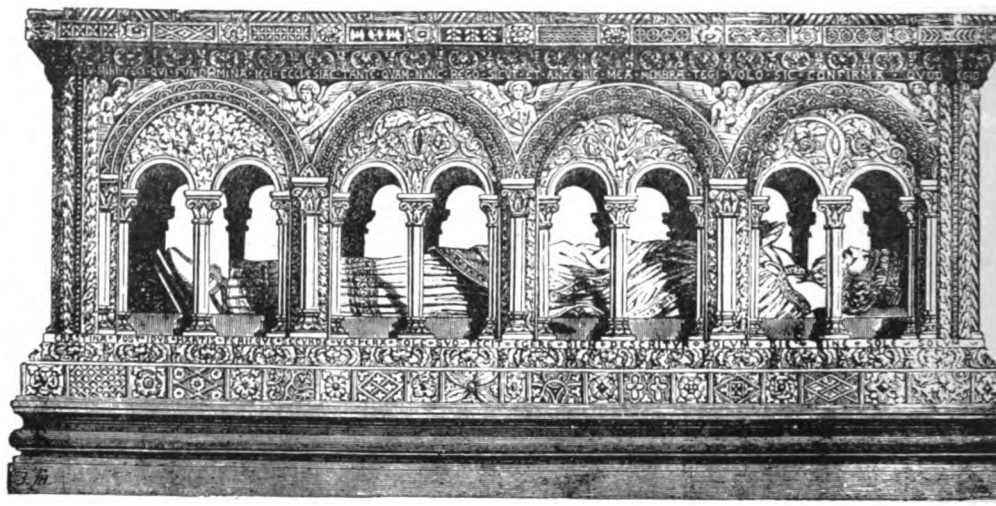
Rose-window, 12th Century

Flamboyant rose-window, 15th Century

"Christ surrounded by Evangelists." In 10th to 12th Century tympanum

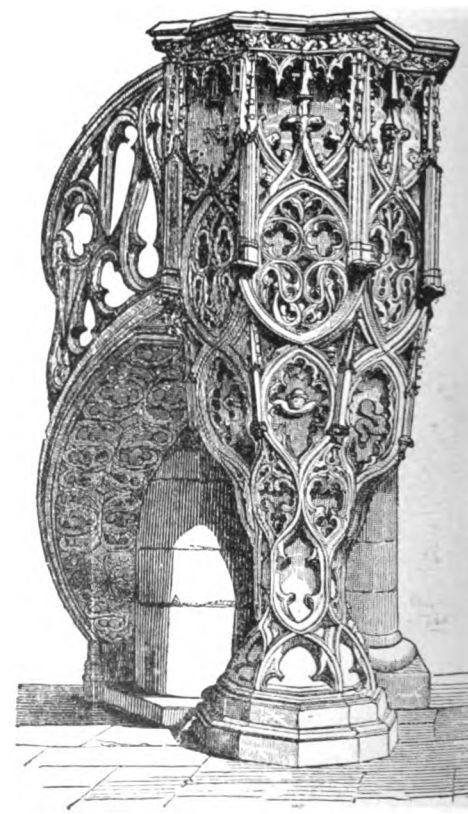
Octagonal Church of l'Aiguille, at Puy-en-Velay, France (10th or 11th Century)

Baptismal font in Basle Cathedral



Tomb of Henri I, Count of Champagne (1180)

Statuary of 13th Century with " tabernacles "



Pulpit, dated 1586, in a church at Basle, Switzerland

shallow octagonal basin; the early rite was one of submersion. Even when they built baptisteries in circular form the font persisted in its octagonal shape. Baptisteries continued to be distinct, if not always detached, buildings for eight centuries after Constantine's time, but later the fonts (still octagonal) were placed in the church near the main entrance to maintain the idea of initiation to the convert.

Funeral chapels were a common purtenance of the church buildings, but have long since become obsolete and the old structures have decayed, so we know little of them. They were termed *memoriæ* and commemorated certain saints or martyrs. Two extant (both at Ravenna) are the mausoleum erected by Galla Placida for the remains of herself and her two sons, the Emperors Honorius and Valentinian; the other erected to the memory of Theodoric the Goth, raised by his daughter Amalasuntha. Most of the art productions of the catacombs and ancient Christian Rome have been obliterated by time, the extant remnants are in the Museum Christianum (Vatican) and in the descriptive work 'Roma Sotterranea.' Art compositions were mostly confined to symbolism. Our Saviour, the Good Shepherd, is found invariably depicted in the central space in the Catacomb domes, the others distributed around the walls. There were the Saviour on the Symbolic rock, or mountain of Paradise with four rivers (mostly found on fronts of sarcophagi); "The Fall," Adam and Eve standing to right and left of the Tree of Knowledge, round which the Serpent coils; Noah and the Ark; Abraham's sacrifice; Passage of the Red Sea; Moses striking the Rock; Jonah swallowed by the Whale; Jonah disgorged; Daniel in the Lions' Den; the Nativity; Adoration of the Magi; Saviour turning Water into Wine, etc. Some 40 have traditional form. These pictures were continued by the Latin Church in sculpture and painting for many ages, probably under special sanction.

Byzantine Art.— The Byzantine church plan was a modification of the Roman basilica (see BASILICA) and we now have four naves of

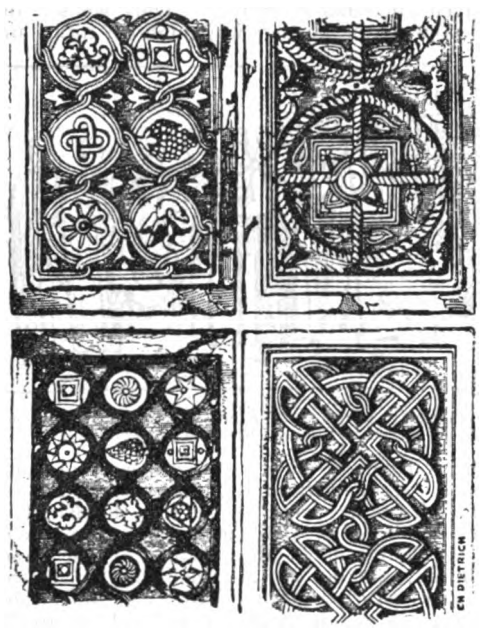
Byzantine mosaic of Empress Theodora entering the Temple, in S. Vitali, Ravenna (6th century).

pillared avenues instead of one; they are of equal length and breadth, at right angles, forming a cross. In the centre, combining the terminations of the naves, arose the dome or cupola. (See BYZANTINE ARCHITECTURE). The Byzantine church edifice was adorned with mosaics. The floor was paved in the style termed *opus Græcanicum* (or *Græcum*), while finer incrustations covered the *ciboria* (domes) and reading desks. A peculiarity of Byzantine (and contemporary) depiction is the representation of personages of superhuman power being given superhuman stature. Thus we see the devout paying homage in diminutive forms and

Byzantine mosaic of St. Maximinianus and Emperor Theodosius in S. Vitali, Ravenna (6th century).

the courtiers in pictures of emperors are pigmies. Monuments of Byzantine mosaic art are the 6th century work of the Holy Eucharist in the basilica of S. Apollinari di fuori (Ravenna); Transfiguration in the tribune of the same church; another in S. Apollinari di dentro, 'Approach of the Three Kings'; Justinian and Theodora in the wall of the tribune of S. Vitali, Ravenna. The mosaics in the nave and triumphal arch of S. Maria Maggiore, Rome (5th century). Other noted Byzantine mosaics in Rome are in S. Pudenziana, S. Prassede (9th century). Two centuries of war and barbarism in Italy intervene, while in Greece work was being done by such artists as Georgius, Pantaleo, Nestor, Menas, Symeon, the Blachernæ on the illumination of the vellum Menologion for Emperor Basil II (10th century), now in Vatican. Beautiful work had already been done on such manuscripts as Book of Joshua, in Vatican; Genesis, in Imperial Library, Vienna; Syriac Gospels, in Laurentian Library, Florence. A 9th century fresco in Byzantine work adorns an absis wall in S. Cecilia in Trastevere, Rome. By the 11th century decadence had set in, but fine work was done on such pieces as the ivory tablets inserted in the missals binding presented to Bamberg Cathedral by Saint Henry (emperor), now in Munich Library, and the bronze gates, done at Constantinople in 1070, for the basilica of S. Paolo fuori le mura (Rome). To this period belong the S. Marco *pala d'oro* and ciborium. Byzantine art revived in the 12th century; examples are the mosaic in San Clemente, Rome (1112); others in San Marco, Venice; in the tribune of the Duomo at Murano and those at Torcello. The Latin conquest (1206) and that of the Turks (1453) stifled and killed Byzantine art. Beautiful work was done in goldsmithing and enamels (see ART ENAMELS; GOLDSMITHING; for church plate, altar-pieces, see ALTAR); the emperors made great gifts of such work to the different churches. Carved ivories show more freedom of expression than, perhaps, other mediums. In viewing the work of the Byzantine

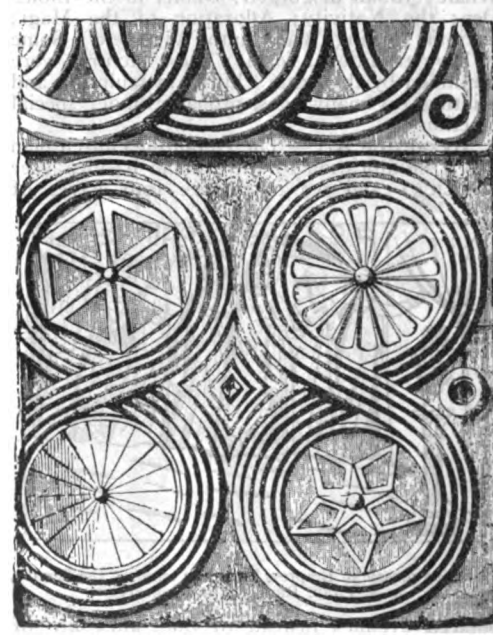
artists we find a primitive method of expression which often belies the perfection of execution. Draperies are apt to hang in folds suggestive of a series of ropes; the facial expression is



Merovingian moldings in S. Maria-Trastevere, Rome.

often crude to extortion. They are methods laid down rigorously by the church and rigid conventions are still, more or less, maintained in oriental ecclesiastical art in Russia and the Greek Church.

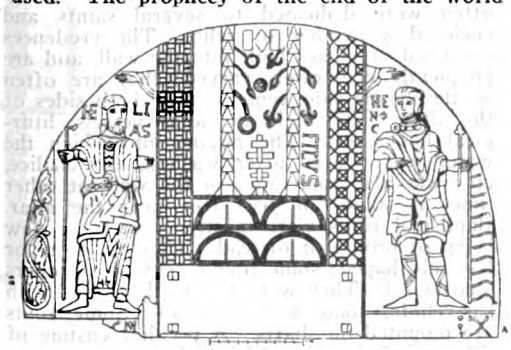
Romanesque (Lombard or Italo-Byzantine).— This is a cruciform ground-plan for churches; the nave or arm continuing west from the sanctuary is lengthened, transforming into a Latin cross (+) the former Greek cross (+) plan. Three entrance doors are usual on the western front, mostly covered with sculpture. Over the central door a "Saint Catherine wheel" window is usual. Galleries of pillars or trefoils range themselves all around beneath the roof's eaves. Galleries of such pillars sometimes cover the western front, rising tier on tier reaching even to the pediment and engirdling the cupola. They are mostly for purely decorative purposes. The baptistery and the campanile (bell tower) belonging to Lombard cathedrals are detached adjuncts of the church edifice. The arch is always round in pure Lombard architecture. (See ARCHITECTURE). Early style is seen in the façade of S. Michele at Pavia; Victory of Saint George over central door; Jonah vomited by whale (right and left doors); diverse dragons, griffins eagles, sphinxes, snakes, centaurs, etc., all very crude. Better work is found to the left of the doorway of S. Zenone, Verona (two warriors charging) and King Theodoric to the right. Next period improves, as shown in monsters introduced in church pillars, often of admirable execution. Two lions on porch of S. Cyriaco, Ancona, perhaps are the finest in this style. Sometimes monsters appear on cathedral roofs, as the bronze hippogriff was, that is now in the Campo Santo, Pisa. All this was Teuton element. Byzantine influence is shown in the work of Wiligelmus at Modena: the King Arthur bas-relief in the doorway near the Campanile; story of S. Gimignano on southern side of cathedral; Passion of Our Lord in the chapel. Contemporary is the Last Judgment bas-relief in the façade of the cathedral at Ferrara; Biduino's work (flourished about 1150) over baptistery door at Pisa; bronze door to Cathedral of Monreale (Sicily) by Bonanno (flourished 1174–86). Antelami's (flourished 1178–1206) Deposition in Parma Duomo is greatly admired. Mosaicists were considered as painters and held chief positions in art depiction till the Dominicans and Franciscans patronized the actual painters — Guido of Siena, Giunta of Pisa, Cimabue of Florence (master of Giotto), etc. Guido did the Madonna of S. Domenico (1221). Giunta did the decoration of the Upper Church of the Franciscans at Assisi. Margaritone (architect, sculptor and painter) belonged to this period. Cimabue did the Virgin and Child in the gallery of the academy, Florence; worked on the Assisi Upper Church fresco decoration; did the crucifix now in the S. Croce sacristy, Florence, and painted the noted Madonna for the chapel of S. Maria Novella. Other painters were Buffalmacco, Florence (1311–55); Tomaso de Stefani, Naples (about 1230–1310); Filipo Tesauro, Naples (about 1260–1320); Bertolino of Piacenza and Niccolo of Reggio (flourished about 1260). Noted in this period were Fra. Giacomo da Turrita, the Cosmati, Pietro Cavallini, Andrea Tafi, Gaddo Gaddi, Andrea Orcagna, etc.



Merovingian molding in St. Irene, Lyons.

France.— Nothing remains in France in the way of church buildings dating from the 4th, 5th and 6th centuries. The only extant ecclesiastical mementoes in stone of this Merovingian

period are numerous gravestones, capitals, mouldings, etc. A predominating motif in such carvings is the complex interlacing lines like wattle-work termed "lacertine" ornament. This method of intertwining and curving of numerous parallel lines in rounded bas-relief is contrived in *guilloches* (opposed waves intertwining to produce a series of circles, etc.), rosettes, even crosses. Crude foliation and floriforms intermingle with conventional bird forms (the symbolic peacock is frequent), contorted interlacing dragon and dog forms. The vaults and walls of the church edifices as well as the paving sometimes consisted of mosaics. Altars, while mostly of stone, were sometimes of wood. (See ALTAR). In the Carlovingian (spelled also *Carolingian*) period (752–987) the powerful genius of Charlemagne becomes felt but, as Viollet-le-Duc says, our ideas of the primitive churches are very vague and it is only after the 10th century that we gain some conception of them. (See ARCHITECTURE). The fragments of ecclesiastical stone carving would make it appear that the same motifs as in the former period were in use: the interlaced ornament, the birds and other symbolic animals, but the lozenge (diamond) form is frequent. The treasuries of the church were becoming very rich in objects of art. Altar and ceremonial pieces, such as chalices, patens, crosses (see CHALICES, CROSSES, GOLDSMITHING, etc.) were liberally donated by kings and nobles. These gold objects were often encrusted with garnets and ruby-colored glass paste in cloisons (bezels). Of such were the gold goblet and plateau recently discovered at Gourdon and the chalice and paten of Saint Goslin, bishop of Toul, green and blue enamel (see ENAMEL) figuring in the latter. Textile fabrics of this period and the former are very rare, most of those discovered in France being attributed to Byzantine manufacture, but found in a number of French churches. With the 11th century we commence the second French Romanesque period. As the 9th century found but few of the Merovingian edifices still standing, it is likely they were built of very perishable material. But the buildings of the period in consideration were more stable, stone being the main substance used. The prophecy of the end of the world



Mosaic paving (10th century) of Cruas, Ardèche (France)

having lost its discouraging effect with the passing of the 10th century, when the disaster was to arrive, the perspective broadened. Their ground plans differed, many copying the form used by Charlemagne at Aix-la-Chapelle, which, in turn, was a reproduction of S. Vitali of Ravenna and others. (For further information see ARCHITECTURE). The ornament is becoming more and more enriched with carvings of birds pecking at fruit, strapwork, geometric repeat forms ("dog-tooth," lozenge, "pearl and button") and acanthus leaf. The tympanum

Carlovingian "lacertine" decoration.

over the door begins to obtain quite elaborately carved subjects as groups of ecclesiastical symbols of the Evangelists, full figures of Christ, etc. In the second half of the 12th century "wheel-windows," with columnar radiations starting from a circle in the centre and reaching to the periphery, appear at the extremities of the transepts above the western portal; these round windows are found on a number of churches of this century. Belfries are rare before the middle of the 12th century. The placing of vanes in the form of a cock, acting as wind indicators, dates very far back, the poet Wolstan (end of the 10th century) mentions the cock on Winchester Cathedral, and the Bayeux tapestry shows one on Westminster Abbey. Many were gilded. They were a symbol of the church to be ever watchful. The iconoclasts had done much to hinder the artistic expression of Christian sculptors and painters and former crude and unnatural depiction was largely due to fear of beauty in statuary or pictures leading to idolatry. But, by the 12th century, the figures coming from ecclesiastical artists were speaking a new language, besides displacing zigzags, lozenges, meanders and other geometric designs on archivolts and voussures over doors where human forms are now found. High relief stone carving of large size figures are now seen on the façades and on the decorations at the sides of doorways, representing personages of the Old and New Testament. They are done by the best sculptors available. Most of them are clothed in long tunics surmounted by a kind of mantle opening in front and disclosing richly adorned materials, often edged with gold or silver lace. A peculiar feature of these statues is the extreme length of bust, protruding eyes, arched eye-brows, stiffness of movement, all vestiges of the Byzantine style; the same char-

acteristics prevail in bas-reliefs and paintings. They also retain the same Byzantine treatment of Christ enthroned, the right hand in benediction; symbolic representations of the Evangelists surround Him (eagle, angel, lion and ox). His feet rest on a stool (*scabellum*); waves like water figure sometimes at the side of the stool. In other cases Christ is accompanied only by two angels, one on either side, holding censers and in the attitude of prayer. An altar dedicated to the archangel Michael is sometimes found in large churches, above the central doorway, or above the porch where the latter does not exist. Where the façade boasted two towers we sometimes find one has an altar dedicated to the archangel Gabriel and the other one dedicated to the archangel Raphael. All such holy personages are found nimbed (see NIMBUS), as also is the lamb (usually carrying a cross), when representing Christ crucified, and also the dove, when representing

Holy Dove — Holy Spirit.

the Holy Spirit. Other subjects of iconography of the period are the Sirena (terminating as a fish), Manicora (human head, globular body, tail of fish), elefans (elephant), and numerous other fantastic creature symbols as shown in the contemporary illustrations of the "Bestiary" books. Mural painting was successful in the Romanesque period. The walls and vaults were covered with fresco polychrome work. Unfortunately few have escaped the renovator, but the remnants afford some idea of the work done. Some columns were painted red, some capitals green; the vaults were, of course, sky-blue. Proofs survive that often bas-relief figures were painted in a different color to the background, also that clothing was painted and gilded. Scriptural scenes were usual. We find in the church of Saint Savin, in Poitou, depictions of the Holy History and the Apocalypse, history of Saint Savin and of Saint Cyprian, combat of Saint Michael with the dragon. Other mural paintings are at the churches of Saint Julien at Tours, Notre Dame de Rivières, near Chinon; at Tavan, near Ile-Bouchard, etc. Perspective is absent.

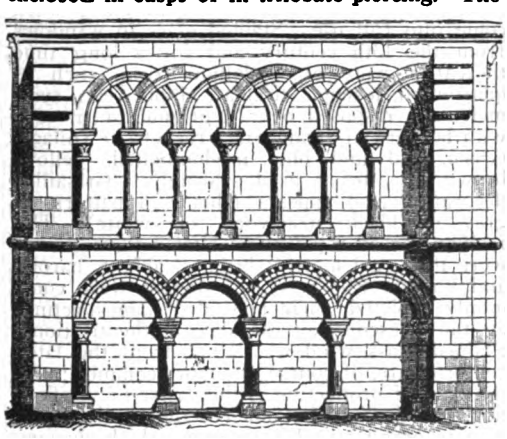
Germany and England.— While France is devoid of Romanesque ecclesiastical buildings, a number still remain in Germany, such as those found in Cologne, Lorsch, Aix-la-Chapelle, Gernrode, Worms, Hildesheim (see ARCHITECTURE). In England, Edward the Confessor determined to rebuild Westminster Abbey after Norman style (he had lived in exile in Normandy) and it was finished in 1065. Part of the monastery still exists. There are also other Norman churches in England.

Illuminated Manuscripts.— The manuscripts of the Romanesque period naturally partake of the very numerous motifs found in the Romanesque plastic art. In the luxuriously illuminated liturgical books are found border and initial decorative motifs such as palmettes, acanthus leaves, vines, meanders (Grecian key pattern) and wattle work ("lacertine"), or combinations of foliage and geometric figures. This complex interlaced work decoration of manuscripts is quite universal, spreading from the Lombard, Merovingian, Carolingian, Western Gothic manuscript right into the 16th century. Mingled with this involved interlacing is foliation, figures of humans, dogs, fishes, birds, dragons, etc. Repeat motifs, true copies of moldings taken from church edifices are often utilized in the manuscripts. The use of architectural motifs includes pillars, capitals, etc., and even extends to the point of absorbing the arch above the pillars. We find also the Oriental horse-shoe form of arch in these illuminated works of the period. Pointed arches also appear in these works centuries before in actual use in buildings (Humann). Finally, we have whole sectional views of church interiors, frequently with active human groups displayed. Among the most beautiful Carolingian MSS. are the Sacramentary (about 750) in the National Library, Paris; Ada Codex (about 775) in Municipal Library, Treves; Psalter of Dagulfus (about 780) in Imperial Library, Vienna. In Saint Gall, Switzerland, a magnificent collection of illuminated MSS. is in the Abbey and the Town Hall Library. Some of the masterpieces are the Sacramentary of Gelassius (8th century); Golden Gospels of Saint Gall (9th century); Evangelarium Longuin (10th century). Evangeliary of Abbot Angilbert of Centula (about 793) is in Abbeville; Evangeliary of Saint Medard of Soissons (8th century) is in the National Library, Paris; Alcuin Bible (about 800) is in British Museum as is also the Golden Gospels of Athelstan (about 850).

Altar fronts (*antependia*) of the richer churches are frequently of gold or silver and made detachable; magnificent examples are that of Saint Ambrose at Milan; in S. Marco, Venice, Basel Cathedral. (See ALTAR). The Eucharist was preserved in receptacles shaped like towers or doves either suspended or kept in *armoires* (cupboards); they were very beautifully enameled and embellished with relief-work. Altars of the 11th and 12th centuries often were dedicated to several saints and enclosed a number of relics. The credences consisted of niches built into the wall, and are frequently elaborately carved; they are often on the epistle side, sometimes on both sides of the altar. They held the altar vessels, liturgical books, etc. The *piscina* into which the water was poured after washing the chalice, etc., was also sometimes in the wall, at other times it stands on legs free near the altar. Baptismal fonts were mostly of stone, a few being of bronze or of lead. They are more or less tub-shaped; some round, some oval, others quarterfoil. They were frequently carved with bas-reliefs, some with columns. Some fonts are mounted on shafts. A peculiar custom of this period was that of erecting very substantial towers in the centre of the large cemeteries surmounted by a lantern in which light was burned at night, a species of beacon. In the base of these towers was a truly orientated altar at which mass for the buried was read. Some of the tombs of this period were very large elaborately carved architectural monu-

ments, their sides consisting of arched colonnades; examples are seen in that of Treves Cathedral erected to Cardinal Ivo (1142), and that of Henry I, Count of Champagne, formerly in the church of Saint Étienne at Troyes. In the 12th century commenced the practice of carving an effigy of the deceased for the tomb. Of such are those of Richard I (Cœur de Lion), Henry II and his queen at Fontevrault; painting brings out clearly the draperies of their costume. Some tombs are heightened with enameled copper or silver, as those of Henry I, formerly at Saint Étienne at Troyes. Great chandeliers or «crowns of light» were frequently suspended in the churches of this period, such as those still existing at Hildesheim and Aix-la-Chapelle. See CHANDELIER; CORONA.

Gothic Period.—The Gothic style of architecture is frequently termed pointed or ogival, on account of its pointed or ogive arches. (See ARCHITECTURE). In the 12th century this style is in its transitional stage and, therefore, we find moldings, capitals and column shafts in Romanesque decoration. The ground-plans become more and more complex, with numerous excrescences in the interiors, buttresses, flying buttresses, etc. A great change in the treatment of architectural ornament in this style is noticeable. Oriental plant life, chiefly acanthus, that prevailed during the Byzantine and Romanesque periods, now gives place to motifs taken from the European vegetable kingdom, and conventionalization of such forms; we now see ivy-leaves, oak-leaves, roses, willows, leaves of the water lily, strawberry plant, ranunculus leaves, and the rounded leaves of the trefoil, conventional violets. Crockets break the continuity of lines on angles or edges, sometimes these crockets terminate in human forms or the heads of animals. «Rose» windows take the place of the former «wheel» windows, and their open spaces are enclosed in cusps or in trilobate piercing. The



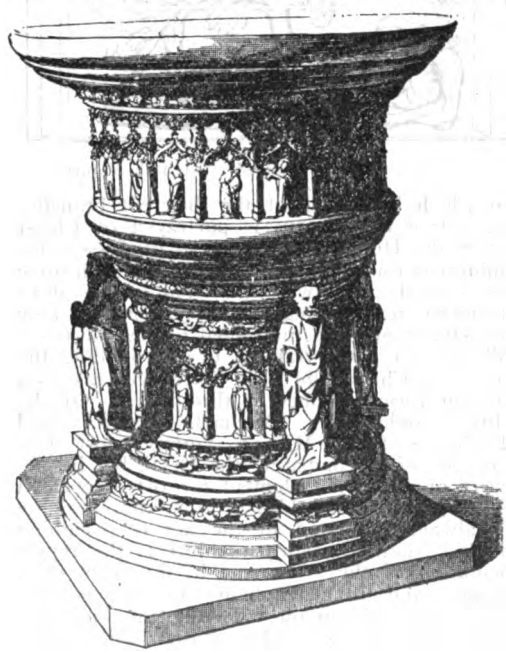
Twelfth century arcade work.

human form, facial expression and drapery, by the 13th century, takes on softer and more natural depiction. Generally carved out of the architectural stone itself, very salient parts (such as forearms, etc.) are frequently done separately and attached and fastened by iron cramps. Statues are usually placed in recesses (niches) and are supported on consoles (*cul-de-lampes*) an architecturally designed canopy projects over the head; the combination is termed a «tabernacle.» The stone-carving of this period discards former simplicity and becomes very rich and complex. A favorite subject for treatment is the «Tree of Jesse»

"Tree of Jesse" in carved wood, 15th century.

in which by means of the different branches of a tree the descent is portrayed of Christ from the House of David, son of Jesse; this subject is found in numerous cathedrals in stone or stained glass windows. The single dove formerly representing the Holy Spirit is now sometimes pictured multiplied as several (usually seven) birds framing or surrounding the image of Christ; the Holy Spirit even takes on human form at times in this period. Of the three archangels (Michael, Gabriel and Raphael), Saint Michael figures most frequently, often combating the Devil, but in pictures of the Last Judgment (so often repeated in the tympana of 13th century churches) he is always presented in the act of weighing souls. Another favorite subject is the representation of the synagogue in the form of a woman and the triumphant Christian religion as a crowned person receiving the blood of Christ in a chalice. Other chosen subjects are: The Four Rivers of Paradise (four overflowing urns); the four Evangelists; the four great prophets; the 12 minor prophets; the Sibyls; the 12 Apostles with their appropriate symbols; the virtues and vices; the zodiacal signs (representing agricultural work of the seasons), etc. In the 14th century the quatrefoil becomes a predominating ornament; while the former plant life motifs are continued the wild vine leaf is added. From the 14th century the Holy Virgin is pictured standing with the

child in her arms, whereas before she was usually seated, the child resting in her lap. In the 15th century sculptured work becomes more pretentious as to pose and drapery but shows "dryness" in execution. The "Father Eternal" is frequent, clothed in the costume of the Pope and wearing his tiara. He holds a large crucifix before him, a dove appearing between the head of the Father and summit of the cross — evidently symbolic of the Trinity. Baptismal fonts assume, for the most part, four pillars as corners, in the 14th century, and, whereas in the 13th and 14th centuries those of octagonal exterior had round interiors, they are in the 15th century given octagonal interiors conforming to the outside form. The fonts of the 15th and 16th century have the basin composed of two parts, one only to hold water; the custom of infant submersion was no longer practised, so the child, placed in the empty section, was sprinkled with water from the other. Some fonts of this period have a form somewhat resembling a great chalice, the exterior of the basin flares out upward into octagonal cup shape, an octagonal short length of shaft beneath supports the basin on a flaring base. One of these, in Basel Cathedral, is elaborately carved; eight panels disclose biblical subjects in relief, with a border above of foliage, the shaft is pierced with octagons, the base has Gothic mullioned traceries and eight reclining human figures at the corners. Saint Sebald's



Bronze font in St. Sebald's church, Nuremberg (15th century).

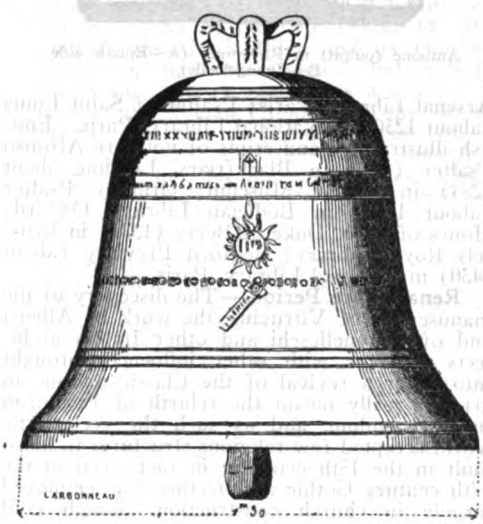
church, Nuremberg, has a beautifully decorated font of circular form, the member serving as shaft or support having the full-length figures of the four Evangelists standing equidistant, their feet supported by the base. Some fonts have conical highly decorative covers. Some time after the 14th century jube screens appear in churches, highly decorative barriers separating the nave from the choir and supporting the rood-loft or gallery. One of the most magnificent is that at Alby, constructed of white stone; other noted ones are at Folgoat, Brou, Troyes and other French churches. Some are constructed of carved wood. Until the 15th century but few pulpits are met with, such as those of Strassburg and Freiburg; those of Saint Lo and Vitré (France) are outside the church for outdoor exercises. They have very elaborately carved canopies in architectural design. Among the most prominent of the interior fittings of the church are the "stalls." They are generally of intricately carved wood-work, and served as seats for the members of the choir. They are separated by arms, and the seats are constructed so as to be turned up during that part of the ceremonies in which the celebrants are in standing posture. Beneath the seat is a flat-topped projection which, when the seat is upturned, serves as a slight rest during prolonged standing. These console-shaped rests are termed "misericordes," and had, generally, carved work of the most grotesque character. The backs of the stalls reached high up, to keep off draughts, and were also treated architecturally and had beautiful canopies or hoods. Examples of great beauty exist at Amiens, Saint Martin-des-Bois, Rouen. For some unknown reason, both the monks and lay woodcarvers allowed themselves much license in depicting grotesque figures, both human and animal, in uncouth postures, little appropriate to the solemn ceremonial occasions for which they served. Another important piece of church furniture, usually of carved wood, was the lectern or reading desk. It generally took the form of an eagle whose spread wings acted as support for the book.

Stained Glass Windows.— Up to the Gothic period the painted mural decoration required a fairly strong light, and that colorless as possible, for its appreciation; therefore stained glass was not in over-frequent use. Now, however, the talents of the artist in glass work come into full use. Stained glass in windows from the 13th century and for a long time thereafter were of medallion form, such as quarterfoil, lozenge, circular, elliptic, etc., symmetrically disposed over a ground of mosaic, with borders of strapwork, crockets of foliage. Green, red and blue predominated, yellow, brown, etc., being used sparingly. "Grisaille" decoration also appears (this is a pattern of gray or black strapwork, on white). The fashion spread rapidly and human figures soon were the usual motifs; bishops, abbots, barons and knights who were the donors were commonly depicted, their appended names acting, at the present day, as date authentications. Stained glass windows dating from the later centuries are, of course, the more common; and the date of production is the easier of verification from the fact that much of the detail is given over to architectural decoration, which changes as the Gothic periods advanced from primitive or (Early), Pointed (or pure), to Florid (or Flamboyant). Fine examples are the following: Of the 13th century (Early Gothic), those at Chartres Cathedral; those in the cathedrals of Le Mans, Bourges, Poitiers, Rouen, Chalons-sur-Marne, Angers, Laon, Coutances, Beauvais, Rheims, Sens, Tours, Auxerre, Troyes, Amiens, Notre Dame de Semur, Sainte Chapelle and

Notre Dame, in Paris; the Becket windows in Canterbury Cathedral and those of York, Lincoln and Salisbury. Of 14th century (or middle Gothic), are those in Gloucester Cathedral, Tewkesbury Abbey, Merton Chapel and Saint Michaels (both in Oxford), in the churches at Willesborough, Selling, Chartham, in York Minster, cathedrals of Bristol, Exeter, Wells, Hereford, Lincoln, Ely, all in England. In France are windows of that century in the cathedrals of Evreux, Sées, Beauvais, Nantes, Narbonne, Toulouse, etc. In Germany are those at the cathedrals of Cologne, Strassburg, Regensburg, Augsburg, Erfurt, etc. In Italy are examples in the cathedral of Saint Francis of Assisi, and Santa Croce and Maria Novella in Florence, etc. Of the 15th century (or Late Gothic) specimens of note are those in the Minster, All Saints, Saint Michael's, Saint Martin-le-Grand, all in York; in Winchester Cathedral; Saint Stephen's Chapel, Westminster (London); Saint George's, Windsor; and in many county churches. In France are those in Rouen Cathedral, Le Mans Cathedral, Lady Chapel of Evreux Cathedral, Bourges Cathedral, church of Saint Severin, Paris. In Germany they are found in the cathedrals of Munich and Ulm and Saint Lorenz at Nuremberg.

Paintings and Sculptures.— Niccola Pisano, who founded the Pisano school, did the sculptured "Deposition" at the cathedral of Lucca (1233), then the pulpits of the Baptistery at Pisa and the cathedral at Siena; the shrine (*arca*) of Saint Domenic at Bologna. Arnolfo, Niccola's pupil, did the Gothic ciborium at S. Paolo fuori le Mura, Rome (1285); Giovanni Pisano did the marble shrine of S. Donato in the cathedral of Arezzo, the pulpit of Pistoja Cathedral (1301) and that at Pisa Cathedral. Andrea Pisano did the bronze doors of the Baptistery of Florence (now removed and replaced by Ghiberti's 'Gate of Paradise') and many bas-reliefs on the Campanile. Orcagna started the shrine of the Madonna of Orsanmichaele, to be finished by Ugolino. Agostino and Agnolo of Pisano did the tomb of Guido Tarlati, bishop of Arezzo (in the cathedral) in 1330. Pietro de Stefani did the Gothic altar of Minutoli, Naples. Andrea Ciccione created the Gothic tombs of Ladislas of Hungary (1414) and of Ser Gianni Caraccio, both at S. Giovanni a Carbonara. Giotto did the mosaic in the Navicella di S. Pietro, Rome, painted the wall decorations in the chapel (Bargello) at Florence ('History of St. Mary Magdalen'), also the frescos in the chapel of the Arena, Padua, 28 large frescoes in the Assisi Upper Church and five in the Lower Church; 'Coronation of the Virgin' in S. Croce, Florence; 'Agony in the Garden' in the Uffizi gallery; the crucifix in the chapel of the Ognissanti, etc. (d. 1337). Pietro Cavallini, of Rome (1259–1334), did the 'Crucifixion' in Lower Church of Assisi; Taddeo Gaddi created the frescoes in the chapterhouse of S. Maria Novella (now Capella degli Spagnuoli) and others in the southern sacristy of the S. Croce. Giovanni di Milano did the great altarpiece in Ognissanti, as well as the frescoes (about 1371). Duccio di Buonensegna (1310) painted the cathedral altar at Siena; Simon de Memmo, in 1332, started painting fresco in chapterhouse of S. Spirito, Florence, in 1333 did the 'Annunciation' for Siena Cathedral (now in Uffizi palace) assisted by Lippo di Memmo; in 1317 he did the fresco Madonna in Sala dei Consegli, S. Gimignano. Pietro and Ambrogio di Lorenzo flourished middle of the 14th century; the former did the 'Fathers of the Desert' fresco in Campo Santo, Pisa, and Ambrogio did the allegorical frescoes of the Sala delle Balestre (Palazzo Pubblico). Taddeo di Bartolo did the painting in the chapel of the Palazzo Pubblico (1414).

Bells.— Pope John IX, about 900, ordered bells to be used in churches. Early so-called "Theophilus" bells are in Augsburg Cathedral, Halberstadt, etc. That at Erfurt dated 1497 weighs 13 tons 15 cwt. The greatest bell, called "Czar Rotokol," at Moscow, was cast in 1736, but fell to the ground and broke in 1737; it serves as a chapel. The weight is about 193 tons. But most of the very large bells are for

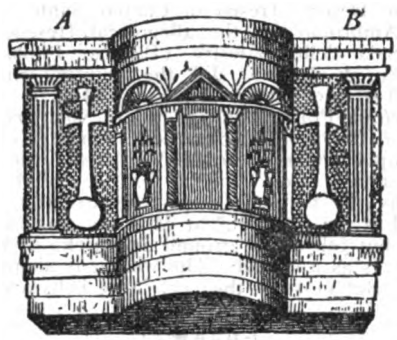


Bell now in the church of St. Pierre at Gaillac (France), dated 1499.

municipal or other civil, not ecclesiastical, purposes. An interesting 15th century bell is that to-day in the church of Saint Pierre at Gaillac, but formerly in Candeil Abbey (France). Its upper inscription is in beautiful Gothic letters, nearly two inches high, starting with a Paschal lamb in bas-relief and above it a cross pattée in a circle; the second inscription is in smaller letters, also Gothic. In the middle of the body is the monogram of Christ (IHS) encircled by 14 flames.

Manuscripts.— Of illuminated manuscripts of this period the most noted German Gothic are: The Salzburg Missal (about 1350) in Munich Royal Library; Passionale of Abbess Cunigunde (1312) in University Library, Prague; Orationale (same date) in same library; Bible of Emperor Wenzel in Imperial Library, Vienna; Gospels of John of Oppavia (1368) in same library; Würzburg Bible (about 1400) in British Museum; Missal of Emperor Frederick III (1448) in Imperial Library, Vienna; Gospels (1498) in Public Library, Nuremberg; Choir Book of SS. Ulrich and Afra, Augsburg

(1489), in Augsburg Library; Prayer Books of Albert of Brandenburg, William IV of Bavaria; Horæ (late 16th century) in British Museum. Anglo-French works are Psalter of Queen Ingeburga (1193–1236) in National Library, Paris; Psalter of Queen Blanche (about 1220) in



Ambone (pulpit) in Ravenna. (A—Epistle side; B—Evangel side).

Arsenal Library, Paris; Psalter of Saint Louis (about 1250) in National Library, Paris. English illustrated manuscripts of note are Alfonso Psalter (done in Blackfriars, London, about 1284) in British Museum; Ormsley Psalter (about 1295) in Bodleian Library, Oxford; Hours of John, Duke of Berry (1380) in Brussels Royal Library; Bedford Breviary (about 1430) in National Library, Paris.

Renaissance Period.— The discovery of the manuscripts of Vitruvius, the work of Alberti and of Brunnelleschi and other Italian architects together with other influences brought into favor a revival of the Classic antique in art. It really meant the rebirth of Paganism in Christendom, and as such the ecclesiastic world accepted few religious structures to be so built in the 15th century; in fact, even in the 17th century Gothic architecture was employed largely in church construction, though civil buildings were erected in the new style. As to church plans, they will be found treated in the article ARCHITECTURE. Concerning ornament in the places of worship, the most lovely stone carving was done on designs of the greatest delicacy and perfect artistic character. Panels and friezes, pilasters and other architectural members were all covered with a profusion of decoration in animal and vegetable motifs in conventional form scrolled and interlacing in capricious but entrancing beauty. They are the Mohammedan Arab conceptions transferred to Italian art ideals and termed by them *arabesques*. They have not the slightest tendency to the canons of ecclesiology, nor do they touch upon Biblical lore. The 16th century pulpit in Basel, Switzerland (see illustration), affords a good conception of the blending of Gothic cusps, flamboyant traceries, quatrefoils, etc., into a Renaissance adaptation for a beautiful piece of church furniture. The arts of painting and sculpture of this period are represented by such transcendent genius as that of Raphael and Michelangelo. But such art subjects are treated in other articles as painting, sculpture, etc.; they scarcely belong to the present topic. For further special church equipment see ALTAR, BASILICA; CHALICE; CROSSES AND CRUCIFIXES; CORONA; CHANDELIER; CATHEDRALS AND CHURCHES; COSTUME, ECCLESIASTICAL; GOLDSMITHING.

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Choir-stall, 15th century.

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CLEMENT W. COUMBE.

ECCLESIASTICAL COMMISSIONERS, for England, are a body corporate with a common seal, perpetual succession and power to hold real estate, constituted by acts 6 and 7, Will. IV, chap. lxxvii, 3 and 4 Vict. chap. cxiii and 13 and 14 Vict. chap. xciv. It consists of all the bishops of the Church of England, the deans of Canterbury, Saint Paul's and Westminster; the chief justices, five cabinet ministers and other legal dignitaries and 12 lay members appointed by the Crown and the archbishop of Canterbury. This body has extensive powers in regard to the organization of churches, the distribution of episcopal duties, revenues, etc. The schemes adopted by the commission, on being laid before the king in council, approved of and gazetted, acquire the force of acts of Parliament. They derive their revenue from an endowment furnished by the wealthiest sees. Consult Whitehead, 'Church Law' (London 1892).

ECCLESIASTICAL COSTUMES. See COSTUME, ECCLESIASTICAL.

ECCLESIASTICAL CROSSES. See CROSSES AND CRUCIFIXES.

ECCLESIASTICAL TITLES ASSUMPTION ACT, a law of the British Parliament, enacted in 1850 (14 and 15 Vict. chap. 60) to prohibit, under penalty, the assumption of ecclesiastical titles (for example: Archbishop of Westminster, bishop of Clifton, dean of Sheffield) by any persons not duly appointed to such stations according to the laws of the realm touching the Church establishment. There was already in the statute book a law of 10 Geo. IV, chap. 7, which provided that any person who should assume or use the name, style or title of archbishop of any existing ecclesiastical province, or bishop of any existing diocese, or dean of any existing deanery of the Established Church of Great Britain and Ireland, the same not having due legal right to such name, etc., should for each violation of the act forfeit £100. But in the year 1850 Pope Pius IX, by apostolic brief, instituted an ecclesiastical province or archbishopric comprising all England and Wales, with Nicholas Wiseman (afterward cardinal) as archbishop, with the style and title of archbishop of Westminster and with 12 suffragan bishops presiding over dioceses named: Beverley, Birmingham, Clifton, Hexham, Liverpool, Newport and Menevia, Northampton, Nottingham, Plymouth, Salford, Shrewsbury and Southwark; none of these towns was then the see of any bishop of the Established Church; and therefore the prohibition of the statute of George IV did not apply. But the announcement of the setting up of these Roman Catholic dioceses provoked a fierce anti-popery agitation and the Prime Minister, Lord John Russell, introduced in the Parliament a bill, which was speedily passed, extending the penalty of the act of George IV to persons who should assume the titles archbishop, bishop or dean "in respect of any places within the United Kingdom." The new dignitaries ignored the act, assumed their titles, braved prosecution and not one of them was ever called into court for contumacy. After the act had stood on the statute book as the law of the realm during 20 years it was amended by the act of 34 and 35 Vict. chap. 53. The penalty was dropped, but the so-called repealing act recited again the legal grounds for the penal enactment and declares that "no ecclesiastical title of honor or dignity derived from any see, province, diocese or deanery recognized by law, or from any city, town, place or territory, within the realm can be validly created"; and that "no pre-eminence or coercive power can be conferred otherwise than under the authority of Her Majesty"; decisions of law that had never been impugned in England since the time of Henry VIII.

ECCLESIASTICUS. One of the deuterocanonical books of the Old Testament. It is found in the Greek Bible and its daughter-versions, in the Latin Vulgate, and in Syriac manuscripts, and recognized as a part of the canon of the Roman Catholic and the Oriental churches, but not included in that of the Palestinian Jews, and therefore counted as apocryphal by Jerome and other Church fathers as well as by the Protestants, and withdrawn from public use in the Greek Orthodox churches of Russia, Serbia and Bulgaria. The title is a transliteration of the Greek *ekklesiastikos* which is the superscription in Cod. 248. It has been plausibly explained, on the basis of a statement by Rufinus, as derived from the custom of referring to books used in the Church, but not in the synagogue, as *libri ecclesiastici*, or "ecclesiastical reading-books," this designation attaching itself permanently to the one especially employed in the moral instruction of the catechumens. In the Greek Bible it is called "The Wisdom of Jesus son of Sirach" or "The Wisdom of Sirach"; Clement of Alexandria and others speak of it as "The Pedagogue" or "The Teacher of all the Virtues" (*Panaretos*). From the prologue to the Greek translation we learn that it was originally written in Hebrew. Jerome states, in his preface to the Solomonic books, that he found a Hebrew copy of Ecclesiasticus, united in one volume with Canticles and Ecclesiastes, entitled "Proverbs." Rabbis of the Talmudic period frequently refer to it under this title, or as "The Wisdom of Ben Sira," or simply as "Ben Sira." About 80 quotations, many of them from the Babylonian Talmud, five from the Palestinian Talmud and a number from other Jewish sources down to the 11th century, have been gathered. Not infrequently it is quoted as "Scripture," showing that, in spite of its exclusion from the Palestinian canon, it still had some sort of recognition, especially in Babylonia, similar to that which it enjoyed in the Church. Saadia the Gaon, who quoted the book, knew of copies provided with vowel-points and accents like the biblical books. Too much must not be inferred from this, however, as he alludes to other writings similarly treated and mentions it in defense of having thus pointed one of his own books. As late as in the 11th century the Hebrew text was known

to Nissim ben Jacob of Kairawan who spread in the West the traditions of Sura. The so-called "Alphabet of Ben Sira," translated by Fagius and published with a commentary by Drusius, is only in part composed of genuine quotations from the book. For many centuries neither Jews nor Christians had any further knowledge of the Hebrew original; and some scholars ventured the opinion that the passages quoted had been translated from the Greek or the Syriac.

The recovery of extensive portions of the lost Hebrew text between 1896 and 1900 was, therefore, as unexpected as it was welcome. Fragments of four manuscripts, covering approximately two-thirds of the work, were discovered. Though the first leaf was brought from Palestine by Mrs. Agnes Lewis Smith, the discovery is rightly connected with the name of Solomon Schechter who surmised whence it came, gained permission to examine the *geniza*, or "hiding-place" for worn-out copies of the Scripture and books not approved for public use, in the synagogue at Cairo, carried to Cambridge a large part of its contents, and identified most of the leaves. The manuscripts seem to come from the 11th and 12th centuries. It is of considerable value that they occasionally overlap, so that in some cases two, for four verses three, are available, especially as they have the appearance of exhibiting to some extent two different recensions of the text. On the other hand, it is to be regretted that so many parts are still missing. Among these is the fine poetic description of wisdom in chap. xxiv, the Hebrew text of which was conjecturally restored by Lowth and Fritzsche; of chap. 1, Fritzsche's translation can now be compared with the original, and the measure of success and failure is highly instructive. The contention of Margoliouth that the discovered manuscripts represent a translation from the Greek made by a Persian Jew slightly acquainted with the Syriac version has not commended itself to other scholars. But though they are, no doubt, descendants of the Hebrew original, they are late copies and have manifestly suffered much in transmission. It is not inconceivable that some changes and additions may be due to a version but it is more likely that they originated in a second recension of the Hebrew text before the Syriac translation was made. The Persian glosses in the margin of one manuscript only indicate the home or nativity of the copyist.

For some parts we are still wholly dependent upon the versions; and the earliest Greek translation remains our oldest testimony to the original text of the whole book. It is possible to show that the translator had insufficient knowledge of both Hebrew and Greek, a failing he shared with other translators of biblical books, but there is less reason for charging him with negligence or arbitrariness than for crediting him with quite unusual efforts to master the Greek language and to acquire a distinct literary quality. Nor should it be forgotten that we are far from having an autograph copy of his work. It can only be approximately restored by a critical use of the Greek manuscripts, such versions as the Old Latin, Coptic, Ethiopic, Armenian, Syro-Hexaplaric and Old Slavonic, and patristic quotations. When this material is closely examined, three peculiarities come to view that demand an explanation. All extant Greek manuscripts (including Cod. 248, as Ryssel and Bollig have verified), as well as the Coptic, Ethiopic, Armenian and Syro-Hexaplaric, have suffered from a dislocation of xxxiii, 13 bc; xxxiv, 1–xxxvi 16a from their original place between xxx, 24 and xxx, 25; while the Old Latin and the Old Slavonic (probably influenced by the Latin Vulgate) have preserved the order exhibited in the Hebrew and the Syriac Peshita. A number of Greek minuscles headed by Cod. 248, printed in the Complutensian Polyglot, the Old Latin, and quotations in Clement of Alexandria and Chrysostomus present a longer text, while the uncial codices and another group of minuscles are free from these additions. Yet in some other respects the former group comes much nearer to the original than the latter. Nöldeke first suggested, and Smend, Hart and Oesterley have developed, a theory that may explain these remarkable facts. It is supposed that a second Greek translation was made, possibly in the 1st century A.D., based on the earlier version, but containing also a considerable number of additions freshly translated from the second, expanded edition of the Hebrew text. This would account for the presence of these additions both in the Old Latin and in the manuscripts and versions having the dislocation. The manuscript in which two layers of 160 stichi were put in a wrong place would be later than the Old Latin, and of such authority as to affect all subsequent copies. It may be surmised that it was Origen's, and that he allowed the additions to stand, though indicating with his usual sign that he did not regard them as belonging to the original Hebrew text. In the uncials and a group of minuscles they were not copied in deference to his direction; in other manuscripts his sign was wholly disregarded. The relative excellence of Cod. 248 in other respects would be due to some good codex from which it was copied.

Concerning the date of the first translation we are unusually well informed. In his preface the translator tells us that he came to Egypt in the 38th year of King Euergetes. Ptolemy III Euergetes cannot be meant, for he reigned only 26 years (247–221 B.C.). Ptolemy IX Euergetes came upon the throne in 170 B.C., and though his reign was twice interrupted, he counted his regnal years from the original accession. There is nothing peculiar about the phrase that is used, as it is found elsewhere in the Greek Bible and in Egyptian papyri of the time, and the objection of Hart that, on account of this king's hostility to foreigners, no Jew would be likely to emigrate to Egypt in his reign is not of sufficient weight to throw doubt upon the national import of the statement. It was consequently in 132 B.C. that the translator arrived in Egypt. His sojourn there had "synchronized" with the remainder of Euergetes reign, when he "found a book of no little learning" or a work similar to the biblical books that had been translated which seemed to him of no small pedagogic value. It appears, therefore, that it was in the time of Ptolemy X Philometor, called Lathyrus (117–108 B.C.), that he undertook to translate this book which he ascribed to his grandfather,

into Greek, fully realizing the difficulties of such a task. His preface is invaluable as a means of determining approximately the date of the original work, and also because it shows that in the time of John Hyrcanus (134–104 B.C.) not only the Law, but also some prophets and other religious books had been rendered into Greek. His description of his grandfather's intention to write a book of the same kind as those he had mentioned, and calculated to serve the same end, and his own manifest purpose to give his translation a place among the books revered by his countrymen in Egypt, throw an interesting light on the slow development of the idea of a canon. In the Complutensian Polyglot another preface of an unknown author was printed. As substantially the same text has been found in the synopsis of biblical books wrongly ascribed to Athanasius, it has been supposed that it was taken from this source. But the reverse is also possible. It is of uncertain age. The translator's name may have been Jesus, and his grandfather's work may to some extent have been a compilation, but the statements in this preface have no evidential value. The Old Latin was not made from the Hebrew, as Sabatier and Bengel attempted to prove. In this version, chaps. xliv-li were not translated by the same man, or in the same country, as the first part of the book. This section is not found in the Armenian version; and there are other indications that it once circulated separately. That the Syriac was made from the Hebrew was already suggested by Cornelius a Lapide and seen more clearly by Bendtsen in 1789; but Bickell and Smend have recognized that it has frequently been corrected with the aid of the Greek. The order of the text in the Old Slavonic renders it probable that this translation has been corrected with the assistance of the Latin Vulgate. This version itself represents only the Old Latin, since Jerome confesses that he "spared" his pen when he came to Ecclesiasticus. The Arabic version was translated from the Syriac Peshita.

The first translator distinctly states that his grandfather's name was Jesus. He probably also wrote the superscription designating the work as "The Wisdom of Jesus, son of Sirach." Before the Hebrew text was discovered, it had been inferred from l, 27 that Jesus was the son of Eleazar, and that Ben Sira was the family name. The Syriac reading in this passage: "Jesus, son of Simeon Bar Sira" was puzzling, and even more so Saadia's reference to the author as "Simeon, son of Jesus, son of Eleazar Ben Sira." But the latter is precisely what we find three times in the Hebrew text (l, 27; li, 30 a b). Most interpreters explain "Simeon, son of" as due to the carelessness of a copyist who, having Simeon on his mind since he wrote l, 1, absentmindedly inserted the words three times in the colophons before the name of the author of the book, and some editors have had such confidence in this explanation that they have simply removed the name of Simeon from the Hebrew text. On the other hand, Schmidt in 1903 proposed to accept the statement in the colophons on the assumption that it referred solely to the Praise of Famous Men (xliv–l) which may have circulated separately at an early time in Palestine as it did afterward elsewhere and may have been written by Simeon a generation later than the original work composed by his father, Jesus Ben Sira. He was confirmed in this view by the very close correspondence between the description of Simon the high-priest in l, 1 ff. and that of Simon, the Hasmonæan high-priest, in 1 Macc. xiii-xiv. The achievements of the former are also recorded of the latter, and the language used is strikingly similar. Simon is called in Ecclesiasticus "the greatest of his brothers, the glory of his people" (cp. 1 Macc. xiv, 4, 5, 26, 29); in his days "the house was glorified" (cp. 1 Macc. xiv, 15) and "the temple was fortified" (cp. 1 Macc. xiii, 52); "the wall was built" (cp. 1 Macc. xiv, 37) and "the battlements of the fortress on the temple hill were constructed" (cp. 1 Macc. xiii, 52); "he cared for his people against the spoiler" (cp. 1 Macc. xiv, 4) and "fortified his city against the enemy" (cp. 1 Macc. xiii, 33; xiv, 37); and he was entitled to wear "robes of honor" and "vestments of beauty" more glorious than those of his predecessors (cp. 1 Macc. xiv, 43, 44). If Simon the Hasmonæan is meant, the closing prayer for the preservation of the high-priesthood in his family and the reference to the promise given to Phinehas are significant. The priests and the people had made Simon's pontificate hereditary (1 Macc. xiv, 41). But a high-priest marching sword in hand against the enemy was a new type that had to be justified by the example of Phinehas (Num. xxv, 6). The promise of an everlasting priesthood as a reward for such zeal helped to legitimatize the new pontifical family, and the emphasis shifted for a while from Aaron and Zadok to Phinehas (1 Macc. ii, 26; Ps. cvi, 30). The Hebrew text in xlv, 24 ff. even suggests that the pact with Phinehas included also the covenant with David, consequently such a union of princely and high-priestly dignity as was first accorded to Simon the Hasmonæan. Against this interpretation it may be urged that this Simon was the son of Mattathias, son of Johanan, while the Simon of chap. 1 is, according to the Hebrew text, son of Johanan (Greek Onias). But the Syriac has Nethaniah, and in the Ethiopic the father's name is not given at all. The original may have read only "Simon, the high-priest." Scholars generally, however, have identified him either with Simon I, who is supposed to be a contemporary of Ptolemy I, or with Simon II, who lived in the time of Antiochus III. The former has, as a rule, been identified with Simon the Just, and it has been thought that he may have repaired the temple and built some wall destroyed by Ptolemy I. Of this there is no evidence, and a man who came to Egypt in 132 B.C. cannot have had a grandfather who lived in the beginning of the 3d century B.C. Simon II may indeed have been a contemporary of Jesus Ben Sira. Josephus ('Antiquities,' xii, 138 ff.) quotes a letter from Antiochus III to Ptolemy V, in which he informs him that he is resolved to confer certain gifts on the Jews for sacrifices and repairs of the temple, and to exempt them from certain taxes. But he does not even suggest that these promises were ever kept, and makes no mention of Simon in connection with them. Grätz deemed it impossible that this "Law-despising Hellenist" could

have been the object of so much praise; but some scholars have recently denied the existence of Simon I, and maintained that Simon II earned by the deeds recorded in Ecclesiasticus the surname of "the Just." In reality Simon the Just is a very shadowy figure. The Talmudic statements concerning him are so contradictory and mixed with obvious legends as to be wholly unverifiable. Grotius supposed that chap. li was written by the grandson of Jesus Ben Sira; and the colophon at the end of chap. l certainly indicates that it is a later addition; but as it exists in the Hebrew, it is more likely to come from some earlier owner of the manuscript. The hymn interpolated after vs. 13 may have been written much later. Galmet and others have been struck by the apparent allusions in ch. xxxvi to the persecutions of the Maccabæan period; they may have come from the hand of Simeon. That the work of Jesus Ben Sira, probably completed about 175 B.C., had received more or less extensive interpolations when it was found by his grandson in Egypt, is now widely recognized. It was suggested in the second preface that the book was a compilation, and this view has been held by many scholars. It is supported by the analogy of Proverbs. Gfrörer maintained that ch. xxiv was copied by the author in Egypt. Ewald thought that only one of the three parts into which he divided the book was written by Jesus Ben Sira. Some sections have the appearance of being anthologies of gnomic sayings. They may have been taken from the lips of the people, heard in the conversation of sages, remembered from earlier reading, or copied from manuscripts; but the author undoubtedly wrote much himself, and his work became impressed with his own view of the world. Lowth recognized its poetic character, and its metrical structure has been recently studied by Bickell, Schloegl, Peters and others. Jesus Ben Sira was a diligent student of the older biblical books. He was well acquainted with Proverbs and Job, but apparently not with Ecclesiastes. His theological views are substantially those of the Sadducees. He has no place for angels. Those mentioned in Job xxxiii, 26, 2 Kings xix, 35, and Deuteronomy xxxii, 8, become, in his rationalistic interpretation, respectively a physician, a plague, and a ruler. He recognizes no devil or demons. He thinks that "divinations, soothsayings, and dreams are vain" (xxxiv, 5). He indulges in no speculations as to the future; he has no Messianic hope. He is convinced that "the son of man is not immortal." In his conception of God, his wisdom revealed in all his works, his goodness that leads to repentance, and his fatherhood are emphasized. In xliv-l an interest in the pomp of the cult, and an enthusiastic loyalty to the high-priesthood, manifest themselves that are not seen elsewhere in the book. The author of these chapters probably lived to see a most glorious high-priest through whom the promises to David had also been fulfilled. Ecclesiasticus is the most complete textbook on morals preserved to us from Hebrew antiquity. It teaches a man how to govern his wife, his children and his slaves; how to deal with his friends and his foes, his superiors and his inferiors, his creditors and his debtors, the rich and the poor; how to behave at the banqueting table and in the house of mourning, in the temple and in the market-place; how to control his passions, practise moderation, cultivate nobler tastes, emulate the example and seek the company of the wise. His moral philosophy is utilitarian and individualistic. The motive is the happiness a certain line of conduct will bring, while the welfare of others is not urged as a consideration. He lays down rules rather than principles, and his work is a noble attempt to commend to the young a righteous and well-ordered life.

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ECCLESIOLOGY, the science of the Church as an organized society, a branch of knowledge which deals with ecclesiastical antiquities, buildings, rites, vestments, organization, principal features and divisions.

ECCLESTON, Samuel, American Roman Catholic prelate: b. Kent County, Md., 27 June 1801; d. Georgetown, D. C., 21 April 1851. He was educated in Saint Mary's College, Baltimore, and ordained to the priesthood of the Roman Catholic Church 1825. He subsequently served Saint Mary's College as vice-president and president; became archbishop of Baltimore in 1834; and established the College of Saint Charles in 1850. He was president of five provincial councils and inaugurated the movement which resulted in the laws for the transmis-

sion of church property from a bishop to his successor and for the excommunication of any Roman Catholic who, after being divorced by the State, should marry again.

ECDYSIS, the process of casting the skin (see MOLTING). The term is used mainly in reference to the exuviation of the pupa of insects and of the outer cuticle of lower invertebrates, as crabs.

ECHARD, or **EACHARD, Laurence**, English clergyman and historian: b. Barsham, Suffolk, 1670 (?); d. Lincoln, 16 Aug. 1730. His 'History of England from the First Entrance of Julius Cæsar and the Romans to the End of the Reign of James the First' (1707) contains a wealth of information, including the particulars of Cromwell's interview with the Devil on the morning of the battle of Worcester. Other historical and scholarly works increased his reputation.

ECHEGARAY, José, hō-sā' ā-chā|gā-rā'ē, Spanish dramatist: b. Madrid, March 1833. He is author of several treatises on mechanics and civil engineering, and was for a time Minister of Commerce and of Public Instruction. Since 1874, when the production of 'The Avenger's Bride' opened a new and brilliant life for the Spanish stage, he has given himself wholly to the drama; producing in a few years 70 plays rich in imagination, dramatic force, and lyric talent. In 1904 he was presented with the Nobel Prize for literature by the Swedish Academy. Of his greatest pieces may be named 'The Great Galeotto'; 'Madman or Saint'; 'Conflict Between Two Duties'; 'A Merry Life and a Sad Death'; 'Mariana' (1892); 'The Son of Don Juan' (1892), based on, and identical in theme with Ibsen's 'Ghosts'; 'The Stigma' (1895); 'The Madman Divine' (1900); to Americans the best-known work with 'El gran Galeoto' (Eng. trans. by Charles F. Nirdlinger). It was produced on the stage by Mr. and Mrs. William Faversham, under the title 'The World and his Wife.' (See GREAT GALEOTTO, THE; SON OF DON JUAN, THE). Consult Vezinet 'Les maitres du roman espagnol' (Paris 1907); L. Antón del Olmet and A. Garcia Caraffa, 'Echegaray' (Madrid 1912); H. de Curzon 'Le théâtre de José Echegaray' (Paris 1912); A. Zacher, 'Don José Echegaray' (Berlin 1892).

ECHELLENSIS, Abraham, Maronite scholar: b. Ekhel in the Maronite country of Mount Lebanon; d. 1664. He was a graduate of the College of the Maronite nation at Rome, and was called to the chair of Syriac and Arabic in the College of the Propagandists and later at the College of France. From 1630 till 1642 he was engaged at Paris in making Arabic versions of books of Scripture for a Polyglot Bible; afterward, from 1652 till his death, he was employed in similar work under the auspices of the Congregation de Propaganda Fide at Rome. He made Latin translations of numerous works in Arabic.

ECHELON, ĕsh'ĕ lŏn (Fr. "a ladder or stepping stone"), used in military language. A battalion, or regiment, marches *en échelon*, or *par échelon*, if the divisions of which it is composed do not march in one line, but on parallel lines. The divisions are not exactly behind each other, but each is to the right or left of the one preceding, so as to give the whole the appearance of a stairway. This order is used if the commander wishes to bring one part of a mass sooner into action and to reserve the other. If the divisions of the *échelon* are battalions, these are generally from 100 to 200 steps from each other. An *échelon* is said to be direct if its head maintains a position perpendicular to the original line, as in direct attack or retreat; it is said to be oblique when it deviates from the line, as in changing the order of formation.

ECHENIQUE, ā-chā-nē'kā, **José Rufino**, Spanish-American soldier and statesman: b. Puno, Peru, 1808; d. Arequipa, 18 Oct. 1879. He joined the Patriotic party as a boy, rose to the rank of colonel and induced the revolted troops of Gamarra and Bermudez to return to their allegiance in 1833; at the battle of Yungay 1839, he fought on the side of Vera Cruz; in 1845 was a member of Castillas council of state, and in 1851 was elected President of Peru. In 1854 he was charged with financial irregularities and Domingo Flias led a revolt against him which terminated in the battle of Saraija 1854. He was defeated in a second revolt at the bridge of Iscuchacha, 2 Aug. 1854, retired to Lima, was again defeated at the battle of La Palma, 5 Jan. 1855, and driven into exile. He was permitted to return in 1862, was elected deputy and later chosen president of the senate. He was even a Presidential candidate in 1872, but spent the last years of his life in retirement.

ECHEVERRIA, ā-chā-vā-rē'ā, **Esteben**, Argentine poet: b. Buenos Aires, Argentina, 1809; d. Montevideo, Uruguay, 1851. He was educated in France, and his early works showed that influence, but he afterward became more national. He was exiled by the Dictator Rosas and went to Montevideo, where he died. Among his works, which are in great repute among his countrymen, are 'Consuelos' (1834); 'Rimas'; 'Cautiva' (1837), containing delightful descriptions of the pampas; 'Guitarra' (1842); and 'La Insurreccion del Sud' (1849). His complete works were published at Buenos Aires in 1874, in five volumes, under the direction of Juan Maria Gutiérrez, an Argentine man of letters.

ECHIDNA, or **SPINY ANT-EATER**, an Australian monotreme animal of the family *Echidnidæ* or *Tachyglossidæ*, closely related to the duckbill, but very different in outward appearance. Echidnas are spiny, porcupine-like creatures, 12 to 18 inches long, with broad bodies, stout legs terminating in large, strong claws well suited for digging, and a small head, ending in a slender snout. The male has spurs like those of the duckbill. The mouth is toothless but the palate bears a number of recurved spines, which answer the purpose of teeth, the tongue is extensile and glutinous. The animal resembles the hedgehog in that it curls up when in danger, presenting its long spines, and protecting by this method its naked belly. It lives in burrows and feeds chiefly on the juicy larvæ of ants, into whose hill it digs with its great claws. Like the duckbill, the echidna lays eggs. The period of gestation is about four weeks. The eggs (rarely more than two), when laid, are carried in an abdominal pouch. In another two weeks they hatch, and the young are carried in the pouch for a considerable period thereafter. The creatures are docile and are easily tamed, becoming playful in captivity and exhib-

iting considerable intelligence. They are nocturnal in habits, and spend periods of drought curled up in their burrows. The common echidna (*E. aculeata*) is found in Tasmania and New Guinea. It is so variable in color and size that it is sometimes held to form two species, differentiated by their general size and habitat. The "nodiak" of Papua (*Proechnida bruijni*) is a kindred animal hunted by the natives for food. See MONOTREMATA; PROTOTHERIA.

ECHINADES, ĕ kĭn'ą-dĕz (modern KURZOLARI), a group of islands at the entrance of the Gulf of Patras, and now in part united to the mainland by deposits brought down by the Achelous River. It was near these islands that the battle of Lepanto was fought in 1571. See LEPANTO, BATTLE OF.

ECHINOCACTUS, ĕ-kī-nō-kak'tŭs, a genus of plants of the natural order *Cactaceæ*, characterized by globular or shortly cylindrical forms with prominent ribs and strong spines. Over 200 species, mostly Mexican, have been described; about 40 species are natives of the southwestern portion of the United States, extending as far north as southern Utah, Colorado and Nevada. The flowers, which are highly colored, mainly in shades of yellow and red, are borne just above the areas producing the youngest spines and are succeeded by dry or succulent fruits of no economic use. The plants are raised with comparative ease from seeds, given abundant light, but not direct sunlight, which tends to dry the little seedlings, supplied moderately with water before the soil has a chance to bake and kept in a temperature of about 60 degrees. When about two inches in diameter they may occupy single pots as specimens. About 50 species are cultivated in American greenhouses and are among the favorite plants of their order.

ECHINOCEREUS, a genus of plants of the natural order *Cactaceæ*, with generally low, thickly clustered stems, mostly short funnel-formed, brilliantly colored flowers of various tints and globose or ellipsoidal fruits which are spiny until they reach maturity. By some botanists the genus is united with Cereus, from which it is distinguished mainly by technical characters that are present in some species of each group. About 25 species are general favorites in American greenhouses. They are cultivated in about the same way as Echinocactus and Cereus (qq.v.).

ECHINOCOCCUS, ĕ-kī-nō-kŏk'us, a small tapeworm (*Tænia echinococcus*), to which is due the disease called "hydatids" in man and in various animals. See TAPEWORM.

ECHINODERMATA, e-ki-nō-dĕr-ma'ta, or **ECHINODERMA,** one of the most distinct phyla of the animal kingdom, embracing the crinoids, sea cucumbers, sea urchins and starfishes. On account of a predominating radical symmetry Cuvier united them with the *Cœlenterata* in his type *Radiata*. Leuckart was the first to clearly perceive that only a superficial resemblance exists between the members of these two great groups and to him is due the elevation of the *Echinodermata* to the importance of a distinct phylum. The skin is always more or less indurated by the deposition of calcium carbonate in the form of variously shaped spicules, spines, discs or plates, either isolated or united to form a reticulum or a continuous test. There is a principal axis around which most of the organs of the body are repeated five times in a radial manner. While this pentamerism is generally predominant, certain organs (madreporic plate, stone canal, "heart") occur in but one radial axis which, therefore, lies in a median plane to which all other organs are bilaterally related. Of the repeated organs the digestive glands, radial canals, nerves, various vessels, the eye-spots and some others, are radial, the genital organs (single in *Holothuroidea*) and polian vesicles interradial in position. The partial suppression of one ray or two rays, and among the starfishes a multiplication of rays, may take place; furthermore, in some *Echinoidea* and *Holothuroidea* certain of the organs or rays may shift so extensively with regard to the principal axis and the median plane that the original pantamerism becomes obscured. There is a well-developed cœlom or body cavity and a closely connected "blood" or pseudohæmal system which consists of an axial organ or "heart," a circumœsophageal ring, radial vessels and a more or less extensive system of lacunæ. In addition to the blood vascular system there is a very characteristic water-vascular system which, when typically developed, consists of a median madreporic or sieve plate and stone canal, a circumœsophageal canal bearing polian vesicles and other diverticula, and giving rise to radial canals which in turn bear rows of ampullæ and tube feet. The latter are the chief organs of locomotion, and the most important function of the water-vascular system is to provide for their distension by means of the water which is strained through the madreporic plate and enters the stone canal. In some cases the tube feet assume an exclusively respiratory function. With few exceptions the sexes are separated and, following fertilization in the water external to the body, a free swimming larval form develops, except in a few cases, from the egg. This is always bilaterally symmetrical, has a curved alimentary canal with mouth and anus, and a more or less complicated ciliated tract or cilia or separate circles of cilia and a pair of cœlomic pouches. Older larvæ often develop irregular processes and a larval skeleton. The larvæ of the several classes differ considerably in structural details and have been named auricularia, bipinnaria, pluteus, etc. The Echinodermata are exclusively marine. The following classes may be recognized:

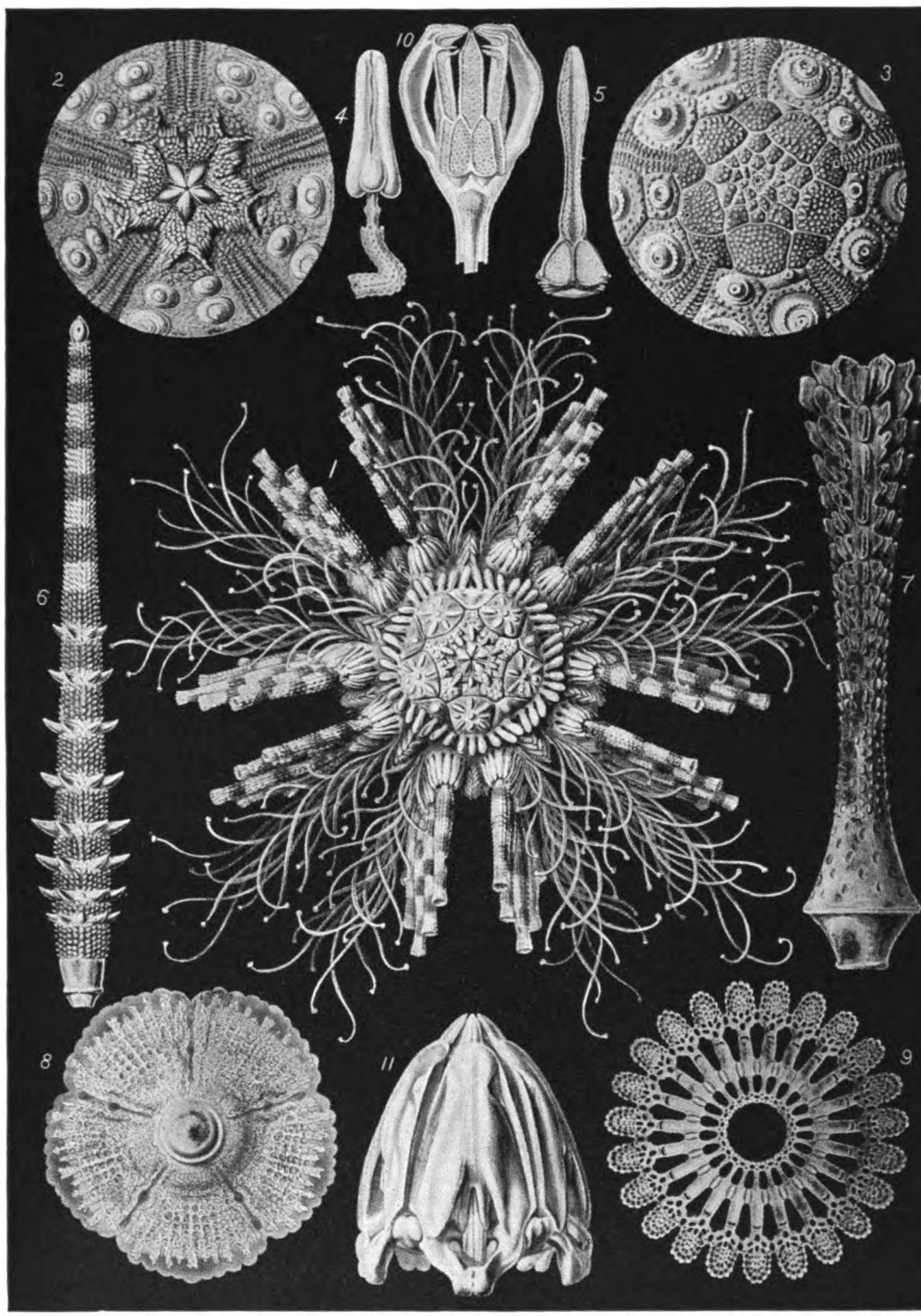
Crinoidea, usually fixed to the sea bottom by the aboral surface; the mouth uppermost and the viscera all contained in the central disc or theca. When arms are present they are solid and usually branched.

Stone or crinoids. Here belong also the extinct blastids and cystids which are often regarded as forming separate classes.

Stelleroidea, never fixed to the sea bottom; the mouth or oral surface always in contact with the surface over which they are moving; tube feet confined to the oral surface; form stellate. There are two quite distinct sub-classes, the *Ophiuroidea,* or brittle stars, serpent stars and basket stars, and the *Asteroidea* or true starfish.

Echinoidea, never fixed to the sea bottom; ambulacral areas with the tube feet extending

ECHINODERMS



1 Cidaris tribuloides
2, 3 Cidaris baculosa
4 Dorocidaris papillata
5 Strongylocentrus nudus
6 Phyllacanthus annulifera
7 Phyllacanthus baculosa
8 Psammechinus miliaris
9 Centrostephanus longispinus
10, 11 Sphaerechinus esculentus

more or less over the aboral surface; form compact, more or less discoid or spheroidal. Sub-classes, *Regularia,* or regular sea-urchins; and *Irregularia,* or irregular sea-urchins.

Holothuroidea, never permanently fixed to the sea bottom; water-vascular system with a circle of oral tentacles; more or less elongated along the principal axis to a cucumber or worm-like form; skeleton in the form of separate plates or sometimes totally wanting. See CUCUMBERS.

Cystoidea, Pelmatozoans with saclike body enclosed in an irregular box. The arms are poorly developed. The mouth is central. The primitive members of the class are spherical. Some genera tend to the Crinoid type; others resemble the echinoids. They appear in the rocks of the Upper Cambrian Age, being the earliest group of echinoderms. They disappeared at the close of the Paleozoic.

Blastoidea, a small, extinct specialized group derived from the cystoids, which became extinct at the close of the Palæozoic age.

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ECHINOIDEA, ĕk-ī-noi'de-a, or **SEA URCHINS,** a class of *Echinodermata* with a more or less spheroidal or discoidal body enclosed in a continuous test or shell composed of polygonal pieces of various shapes accurately fitted together and arranged in radial rows. Alternating ambulacral and interambulacral areas, usually repeated five times, may be recognized. The former exhibit rows of perforations for the tube feet, generally reaching to the aboral pole. The skeletal plates support movable spines which sometimes attain a great size and are used in defense and to a certain degree in locomotion. In addition, the integument bears the remarkable structures known as pedicellaria, which are three-jawed pincers borne on movable stalks, which by continually snapping and bending carry away particles of fæcal matter and secure cleanliness. The beginning of the digestive canal is frequently provided with a complicated masticatory apparatus known as Aristotle's lantern, and the canal itself is tubular and looped, usually not pouched. The gonads are interradial with outlets to the exterior near the aboral pole. Development may be direct or through the larval form called pluteus, which is provided in its later stages with long processes supported by movable spicules. The number of known Echinoidea is very great, many of them being fossil. There are two sub-classes: *Regularia,* form regular, spheroid; mouth and anus at opposite poles of the central axis, and the latter usually surrounded by small skeletal plates; in only a few cases are external gills present. Here belongs the common sea-urchin (q.v.). *Irregularia,* form markedly bilateral; anus always displaced from the apical pole into the posterior interradius and the mouth frequently in the opposite direction, in which case the form is sometimes heart-shaped. Examples are the sand-dollar and heart urchin (q.v.).

ECHINORHYNCHUS, ĕ-kī-nō-rĭn'kŭs, a parasite worm. See ROUNDWORMS.

ECHO, from the Greek, meaning "sound," noise; a sound repeated by reflection, or a sound heard again at its source. The waves of sound on meeting the surface are turned back in their course according to the same laws that hold for reflection of light. Even clouds are capable of producing echoes, as is observed at sea when a gun is fired off under a dense cloud. Echoes from the clouds also, in all likelihood, play an important part in the long rolling of thunder. In order that the echo may return to the place from which the sound proceeds the reflection must be direct and not at the angle to the line of transmission, otherwise the echo may be heard by others but not by the transmitter of the sound. This may be effected either by a reflecting surface at right angles to the line of transmission or by several reflecting surfaces which end in bringing the sound back to the point of issue. To make a distinct echo the reflected sound must be concentrated rather than diffused. To this result a degree of concavity in the reflecting body is conducive. If the sound is repeated several times, which is the case when it strikes against objects at different distances, many echoes are heard. The reflecting surface must be at a certain distance, in order that the echo may come to the ear after the sound and be distinctly separated from it. Sound travels about 1,100 feet in a second; consequently, an observer standing at half that distance from the reflecting object would hear the echo a second later than the sound. Such an echo would repeat as many words and syllables as could be heard in a second. This is called a *polysyllabic* echo. If the distance is less, the echo repeats fewer syllables; if only one is repeated, then the echo is monosyllabic. The most practised ear cannot distinguish in a second more than from 9 to 12 successive sounds, so that a distance of not less than 60 feet is needed to enable a common ear to distinguish between the echo and the original sounds. Echoes at least distances, as from the walls of churches and public halls, are liable to mix with and destroy the distinctness of the original sound.

ECHO, in classical mythology, a nymph (one of the Oreads), who, according to fable, was changed by Hera (Juno) into a rock, because her loquacity prevented Hera from listening to the conversation of Zeus with the nymphs. The use of her voice, however, was left her so far as to be able to repeat the last word which

she heard from others. Another account is that Echo fell in love with Narcissus and because he did not reciprocate her affection she pined away until nothing was left but her voice.

ECHO CAÑON, Utah, gorge formed by the Weber River, in the northern part of the State, not far from Salt Lake, through which the Union Pacific Railroad passes. The high, almost vertical walls of the cañon have fantastic carvings made by the elements, principally water. The peculiar echo heard within the gorge has given it its name.

ECHTER, ĕH'tĕr, **Michael,** German painter: b. Munich, 5 March 1812; d. there, 4 Feb. 1879. He studied at the Munich Academy, as a pupil of Hess, Zimmerman and Olivier. He assisted Kaulbach in work on the mural paintings in the Berlin Museum, painted the 'Battle of Lechfeld' for the Maximilianeum; the 'Betrothal of Frederick Barbarossa with Beatrice of Burgundy' and 'The Burial of Walther von der Vogelweide' for the National Museum in Munich; and 30 scenes from the 'Nibelungenlied' for the royal residence. He was appointed professor in the School of Industrial Arts and was a member of the Munich Academy.

ECHUCA, ĕ-choo'ką, Australia, town and river port of Victoria, on a peninsula at the junction of the Campaspe with the Murray River, 157 miles north of Melbourne. It is opposite Noama, in New South Wales. A roadway and railroad bridge, 1,905 feet long, of the Murray River Railway, connects Noama and Echura. It has a trade, partly by the river, in timber, wool and wine, and the vine is cultivated in the neighborhood. Pop. about 5,000.

ECIJA, ā'thē-hā (Rom. ASTIGI; AGUSTA FIRMA), Spain, a city in the province of Seville, on the Genil, 42 miles northeast of Seville. It is of very ancient origin and according to tradition was visited by the apostle Paul. At a very early period it became an episcopal see, and its importance under the Romans is attested by many ancient remains. The climate is so hot that Ecija is often called the "Oven of Andalusia." It has hospitals, asylums, barracks, theatres. Its principal manufactures are shoes, woolens, leather, silk, flour. Pop. about 25,000.

ECK, Ernst Wilhelm Eberhard, German jurist: b. Berlin, 1838; d. 1901. He received his education at the universities of Berlin and Heidelberg; was professor at Berlin (1871), Giessen (1872), Halle (1872–77), Breslau (1878–81) and thereafter at Berlin. Of his numerous works the principal are 'Die sogenannten doppelseitigen Klagen des römischen und gemeinen deutschen Rechts' (1870); 'Die Verpflichtung des Verkäufers zur Gewährung des Eigentums nach römischem und gemeinem deutschen Recht' (1874); 'Die Stellung des Erben,' etc., in Bekker and Fischer, 'Beiträge zur Beurteilung des Entwurfs eines bürgerlichen Gesetzbuchs' (1890).

ECK, Heinrich, German geologist: b. Gleiwitz, Silesia, 1837. He received his education at the University of Breslau; took part in the geological survey in Thuringia and Silesia in 1862, from 1866 to 1871 he was lecturer at the mining school in Berlin and in the latter year was appointed professor of mineralogy and geology at the Stuttgart Polytechnic Institute. He made numerous investigations dealing mostly with Triassic deposits, the results of which appeared in the publications of the German Geological Society. His principal works are 'Ueber die Formationen des bunten Sandsteins und des Muschelkalks in Oberschlesien und ihre Versteinerungen' (1865); 'Rudersdorf und Umgegend,' in 'Abhandlungen zur geologischen Spezialkarte von Preussen' (Vol. I, 1872); 'Das Erdbeben in der Gegend zwischen Strassburg, Forbach . . . am 11 June 1887' (1892); 'Verzeichnis der mineralogischen, geognostischen, vorgeschichtlichen und balneographischen Litteratur von Baden, Württemberg, Hohenzollern' . . . (1880; with additions in 1901).

ECK, Johann Maier von, a Catholic theologian, life-long adversary of Luther: b. Eck, Suabia, 13 Nov. 1486; d. Ingolstadt, 1543. His father, a peasant named Maier, assumed the name Maier von Eck or Maier of Eck, after becoming bailiff of his village. Johann, at the age of 11 years, entered the University of Heidelberg whence he passed to the University of Tübingen and there at the age of 14 years took the degree of master of arts. Successively at Tübingen, Cologne and Freiburg universities he studied divinity, jurisprudence and mathematics and at the same time was instructor in philosophy. He was appointed professor of theology in the University of Ingolstadt (1510). While on his travels in Italy (1515) he took part in a public disputation in the University of Bologna and won high distinction; in 1516 on a similar occasion at Vienna he had a like success. In 1518 he published a pamphlet, 'Obelisci,' in defense of the Catholic doctrines attacked in Luther's celebrated 'Theses' of 31 Oct. 1517. Eck was now chancellor of the University of Ingolstadt and Luther put forward Carlstadt as a defender of the 'Theses'; Carlstadt not only replied to Eck in print, but challenged him to a public disputation. Eck accepted the challenge and the disputation was held at Leipzig, with Eck as the champion of Catholicism against both Carlstadt and Luther. The disputation was commenced 27 June 1519 and lasted till 15 July. More than a year previously Luther in a letter to one of his friends credited Eck with eminent scholarship and great natural gifts, but after the disputation he was for Luther "a pitiful theologian" and "a miserable sophist." The numerous audience and the townsmen with unanimity awarded the crown of victory to Eck, and Luther, in a private letter to his intimate friend Spalatinus, confessed defeat. Eck, stimulated by his success, devoted himself thereafter wholly to working for the overthrow of his adversaries. He procured from the universities of Cologne and Louvain a condemnation of Luther's writings and was honored at Rome with the commission to publish in Germany Pope Leo's bull *Exsurge Domine* against Luther. But he was received with manifestations of popular enmity almost everywhere; even at Leipzig the bull was solemnly committed to the flames by the students and the populace. On several notable occasions afterward—at the diet of Augsburg (1530), the conferences at Worms (1540) and those at Ratisbon (1541), he was again a principal

champion of Catholicism. Some of his works are a German translation of the Old Testament, and a revision of Luther's translation of the New Testament. His pamphlets and books against the doctrines of Luther are included in 'Operum Johannis Eccii contra Lutherum.' Consult Wiedemann, 'Dr. Johannes Eck' (Regensburg 1865).

ECKERMANN, Johann Peter, yō'hän pā'tėr ĕk'ĕr-mä, German poet: b. Winsen, Hanover, 21 Sept. 1792; d. Weimar, 3 Dec. 1854. He has a permanent place in literature through his record of 'Conversations with Goethe in the Last Years of His Life' (1823–32), which has been translated into nearly all the languages of Europe, even Turkish. He edited the posthumous as well as the 40-volume edition of Goethe's works (1839–40).

ECKERT (Friedrich Eduard), Max, German geographer: b. Chemnitz 1868. He received his education in Löbau and Berlin; taught some time at Löbau and Leipzig and in 1903 became privatdozent at Kiel University. In 1907 he was appointed to the chair of geography in the Royal Technical High School of Aachen (Aix-la-Chapelle). He has published 'Schulatlas' (45th ed., 1912); 'Wesen und Aufgabe der Wirtschafts- und Verkehrsgeographie' (1903); 'Grundriss der Handelsgeographie' (1905); 'Leitfaden der Handelsgeographie' (3d ed., 1911); 'Neue Entwürfe für Erdkarten' (1906); 'Die Kartographie als Wissenschaft' (1907); 'The New Fields of Geography, especially Commercial Geography' (1907); 'Geographisches Praktikum,' with Krümmel (1908); 'Fortschritt in der geographischen Erschliessung unsern Kolonien' (1908 et seq.); 'Die Kartenprojektion' (1910); 'Deutsche Kulturgeographie' (1912); 'Wirtschaftsatlas der deutschen Kolonien' (1912); 'Die wirtschaftliche Bedeutung des Panama-Kanals' (1913); 'Die Metallverbreitung und Metallgewerbe der Welt' (1913).

ECKERT, Thomas Thompson, American telegrapher: b. Saint Clairsville, Ohio, 23 April 1825; d. 20 Oct. 1910. In 1852–59 he was superintendent of the telegraph line between Pittsburgh and Chicago; in 1859–61 superintendent of a gold-mining company in North Carolina; and in the latter year was appointed superintendent of the military telegraph department of the Potomac. Subsequently he was general superintendent of the military telegraph of the army, and was brevetted brigadier-general of volunteers for his services. In 1864–66 he was Assistant Secretary of War; in 1866–75 general superintendent of the eastern division of the Western Union Telegraph Company; in 1875–81 president of the American Union Telegraph Company, and in 1892 became president and general manager of the Western Union Telegraph Company. He retired in 1902.

ECKFORD, Henry, American naval architect: b. Irvine, Scotland, 12 March 1775; d. Constantinople, 12 Nov. 1832. He became a shipbuilder in New York, in 1796; designed and constructed a fleet of war vessels for the United States government in 1812–14; built the *Robert Fulton,* which made the first voyage by steam from New York to New Orleans and Havana; became naval constructor at the Brooklyn navy yard in 1820; and built several war vessels for European and South American governments. At the invitation of the sultan he became chief constructor in the Turkish navy, and established a navy yard at Constantinople.

ECKHART, ĕk'härt, **Johannes** ("MEISTER ECKHART"), the first of the German mystics in order of time and among the foremost in rank; the probable place of his birth is Cologne, and the year 1260 or a little earlier; d. 1329. He studied philosophy and theology in the University of Paris and joined the order of the Preaching Friars, or Dominicans, in which he was promoted to offices of high responsibility, for example, that of vicar-general of the Dominicans for Bohemia, provincial of the order in Saxony. In these places he effected many reforms in the houses of the order and was in high estimation as a preacher notwithstanding the abstruseness of his mystical speculations. Toward the end of his life this dissemination of his mystical views touching the nature of God and the relations between Deity and the human soul brought him under suspicion of being in sympathy with the Beghards, the Brethren of the Free Spirit, the Apostolic Brethren and other fanatics, and 1327 he was cited before the Court of Inquisition at Cologne to make answer to charges of heretical teaching based on passages in his sermons. There he defended the inculpated propositions as entirely orthodox, but expressed his readiness to repudiate them if in the judgment of the head of the Church they were in conflict with the Church's creeds. In 1329 the decision arrived from Rome: 28 propositions contained in his sermons were condemned as heretical and Eckhart was ordered to recant; but he was now dead.

Whether these 28 propositions were or were not formally heretical, contradictory of the express teachings of the Church, they certainly contain doctrines that never have been put forth in any of the Church's formularies. However extravagant, they might have been tolerated or ignored had they been entertained or discussed merely in the schools of theology and philosophy; but proclaimed from the pulpit and addressed to the common people, some of them ignorant, they were incitations to rebellion against all Church authority in teaching. His doctrine concerning the Godhead is plainly pantheistic. For him there is no real being but God. God is the unknown and the unknowable. We cannot validly affirm anything of the Godhead; to predicate anything of Deity is to limit infinity. Yet though God is unknown and unknowable, and though we cannot predicate anything of him, still we can know the true God, the personal God, the Father; in this personal God, the Godhead itself. The triune God, Father, Son and Spirit, is evolved from the Godhead. And the Father comes to know himself in the Son; the return of the Son into the Father is the Spirit. In begetting the Son — who is coeternal with the Father — the Father brings into existence the universal world of things. His death occurred a little while before the arrival of the Pope's condemnation of his doctrines.

ECKHEL, ĕk'ĕl, **Joseph Hilary,** Austrian numismatist: b. Enzersfeld, Austria, 1737; d. 1798. After becoming a member of the Society of Saint Ignatius he was appointed keeper of the imperial cabinet of medals and

professor of archæology at Vienna. Eckhel may be regarded as the founder of the science of numismatics, the principles of which are elaborately developed in his treatise, 'Doctrina Nummorum Veterum' (8 vols., 792–98). He also published catalogues of the ancient coins and gems in the imperial cabinet.

ECKSTEIN, ĕk-stīn, **Ernst,** German humorist, poet and novelist: b. Giessen, 6 Feb. 1845; d. 1900. From the university he went to Paris, and there completed his comic epos, 'Check to the Queen' (1870), and wrote 'Paris Silhouettes' (1873), the grotesque night-piece 'The Varzin Ghosts' and the 'Mute of Seville.' Later he wrote the stories 'Margherita'; 'At the Tomb of Cestius'; 'The Mosque at Cordova.' He was editor of a literary and critical journal, *Hall of Poets,* and of a humorous weekly, *The Wag,* at Leipzig, for some years, and in 1885 settled in Dresden. He also wrote 'The Claudii'; 'Aphrodite, a Story of Ancient Hellas'; 'Decius the Flute-player: a Merry Story of a Musician in Ancient Rome.' He is distinguished by a polished literary style and careful handling of plots.

ECLAMPSIA. See PUERPERAL ECLAMPSIA.

ECLECTIC SCHOOL OF MEDICINE. See MEDICINE, ECLECTIC.

ECLECTICISM (from the Gr. *ἐκ,* out of, and *λεγειν,* to choose or select) is a term that may be applied to any body of theories or doctrines that are combined without regard for their systematic coherence and real unity. We may thus find eclecticism in theology, in philosophy, in medicine, politics or in the sphere of any of the theoretical sciences. The eclectic is usually guided by practical motives: he adopts from the various conflicting systems what seems to him the most plausible and useful opinion on this point or that, drawing now from one school, now from another. He is not concerned primarily with the systematic connection, or even the logical consistency, of these various doctrines with one another, but rather with the plausibility and practical applications of the views taken singly.

In philosophy there have been many men, both in ancient and in modern times — some of them writers of great popularity and influence — who, without attaching themselves to any particular system or forming one of their own, undertook to select from various quarters the particular doctrines that appeared to them to be true and to combine them in their teaching. This eclectic tendency was most prominent in the ancient world during the later period of Greek philosophy, when the theoretical interest of earlier times had greatly declined and when skepticism had infected many of the best minds. The differences between the three principal schools (Platonists, Peripatetics and Stoics) began to be less emphasized and elements from one school were adopted by adherents of another. Moreover, a form of eclecticism appeared in Alexandria also, where thinkers like Philo sought to unite Hebrew theology with Platonic and Neo-Pythagorean conceptions. Cicero, who did more than anyone else to acquaint his fellow countrymen with Greek philosophy, was a thorough-going eclectic, troubling little about the systematic connection of the doctrines and selecting freely from the various schools what seemed to him true. In modern times, the school founded by the French philosopher, Victor Cousin, is known as eclecticism. Cousin sought to unite German idealism, as represented by Kant and his successors, with the Scottish philosophy of "common sense" and the doctrines of Descartes. Consult Zeller, 'Eclecticism in Greek Philosophy' (Eng. trans., 1883); Janet, 'Victor Cousin et son œuvre' (1885); Simon, 'Victor Cousin' (1887).

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ECLECTICISM IN MEDICINE. See MEDICINE, ECLECTIC.

ECLIPSE (Gr. *ἐκλειψις* from *ἐκλειπειν* to forsake the accustomed place, to fail to appear), an obscuration of the light of a heavenly body by another, effected either, directly, by its intervention between the body and the observer, or, indirectly, by its interception of the source of light which illumines the body. The earth, by means of its shadow, may indirectly cause an eclipse of the moon. Similarly, eclipses of the Jovian satellites are caused by immersion in the shadow of Jupiter, and for the system of Saturn a more complicated result arises on account of its ring. When the shadow of a satellite falls upon either of these planets it is called a transit of the shadow. Eclipses are not observable in the other planetary systems, since, in the case of Mars, the satellites disappear in the light of the planet, and with the more distant planets the shadow cone extends too slight a distance beyond the disc. Again, our moon can by its direct interposition between the sun and the earth produce eclipses of the sun. The moon may interpose itself between the stars or planets and occult them (see OCCULTATION), and the other bodies of the solar system may act similarly. The most important of these phenomena are the eclipses of the sun and moon.

Eclipses of the Moon.— A lunar eclipse is caused by the interposition of the earth between the sun and the moon and the moon's consequent immersion in the shadow of the earth. This can occur only when the moon is in opposition to the sun in the heavens, that is, at the time of full moon, and is only possible when both the sun and the moon are near the moon's nodes, i.e., the points where her orbit crosses the plane of the ecliptic. Let the sun, earth and moon be regarded as spherical bodies and their centres ranged in a right line. Then the sun will project beyond the earth a conical shadow called the *umbra,* in which the moon is centrally immersed. The surface of this cone will be described by a line tangent to the same side of both sun and earth and moving about the line joining their centres. The apex of the shadow cone, or of the umbra, is on the average about 857,000 miles beyond the earth's centre, and the diameter of the umbral cone at the point where the moon crosses it on the average about two and two-thirds the diameter of the moon. If, again, two lines tangent on opposite sides of the sun, and crossing between sun and earth, move about the line joining the centres of these bodies, these lines will describe the surface of two cones of which the one extending beyond the earth is that of the penumbra. Unless the moon be near one of her nodes at the time of full moon, she will not strike the

shadow, but pass below or above it. If the sun is less than eight days from a node of the moon's orbit, an eclipse must occur; if more than 15 days from a lunar node, an eclipse is impossible. These are called the lunar ecliptic limits. Since the moon must be quite near her node to produce a lunar eclipse, it may happen that an entire year may elapse without an eclipse of the moon. The lunar eclipses may be either partial or total according as the moon is immersed either partly or entirely in the earth's shadow cone.

The phenomena of a total lunar eclipse are of a simple character. The immersion of the moon in the penumbra can be observed only with difficulty. The edge of the shadow itself presents a hazy outline when seen in a telescope and the times of contact cannot be observed with accuracy. When completely within the earth's shadow, the moon is usually still plainly visible; it is then usually of a dull copper color, although it may be greenish or even of a deep red; usually the moon's disc appears mottled by patches of different colors. The cause of this coloration is the sunlight shining through the earth's atmosphere, suffering absorption of its higher tints and experiencing deflection into the shadow cone through refraction. Lunar eclipses have, however, occurred in which the moon was entirely invisible during the total phase. The obscuration of the earth's atmosphere by clouds accounts for these dark eclipses. The most interesting physical observations effected during its eclipse concern the luminous and heat radiations of the moon. Valuable astronomical observations then possible are the determinations of the times of occultation of faint stars whence precise values of lunar position, diameter and parallax may be derived.

Eclipses of the Sun.— Solar eclipses can occur only at the time of new moon. If the sun be more than 19 days from a node of the moon's orbit an eclipse is impossible, if less than 13 days, a central solar eclipse is inevitable. These are the solar ecliptic limits. The sun causes the moon to project toward the earth at new moon, umbral and penumbral shadow cones differing in the main only in size from those which the earth projects toward and beyond the moon at full moon. The shadow cone of the moon may strike the earth's surface, but on the average it does not. Two distinct cases may arise. *First,* the axis of the shadow cone may strike the earth's surface, and upon it the right line joining the centres of the solar and lunar discs traces the curve of centrality. Here three cases result: (1) The apex of the shadow cone reaches the earth's surface and a central *total* eclipse occurs. (2) The apex of the shadow cone does not reach the earth's surface and there occurs a central *annular* eclipse. (3) The apex of the shadow cone reaches the earth's surface only at a middle stretch of the curve of centrality and there occurs a central *annular-total* eclipse. *Second,* the axis of the shadow cone may not strike the earth's surface but the earth may still enter the shadow cone, or shadow cone produced, and there occur total, annular and annular-total eclipses, all of which are of a non-central character. The path of a total eclipse on the earth may traverse a length from west to east of several thousand miles. An annular eclipse has also a "path of the annulus" in which the annular phase is visible. Outside of both of these paths the sun is only partially eclipsed. The least number of eclipses, solar and lunar, which can occur in a year, is two, and these must be central eclipses of the sun, while the maximum number occurring is seven, two of the moon and five of the sun or four of the sun and three of the moon. A simple record of the date and character of eclipses revealed to early astronomers the fact that after a period of about 18 years eclipses again recur in the same order and kind whether solar, lunar, total or partial. This cycle, called the SAROS, is one of 223 lunar months, each of a little more than 29.5 days, and is precisely 6,585.32 days in length. Depending on the number of leap years, 5 or 4 intervening, this is equal to 18 years 10.32 days or 11.32 days. At the end of the Saros the relative positions of the sun, moon and node of the moon's orbit are nearly the same as at the beginning, and other favoring factors of the motions of the sun and moon also recur, as Newcomb first pointed out, to nearly original values. The excess of one-third of a day in the cycle causes the eclipse to be thrown about eight hours of longitude farther west on the earth's surface. Hence only after three cycles does the eclipse again recur in approximately the same longitude. If the intervening leap years be regarded, the application of the Saros to various series of solar eclipses of the following table may readily be made.

Ancient eclipses are chiefly of value in historical and chronological investigation (see TIME). The records of the supposed eclipses of the ancient historians are usually very uncertain as to place, time and character of the occurrence, and hence have proved of questionable value to the astronomer. The precise circumstances of an eclipse occurring centuries ago can readily be computed from the modern tables, but the comparison with the vague historical references has apparently contributed but little to science. Ginzel has, in his 'Special Canon of Eclipses,' collected a splendid array of ancient eclipse literature, and this has been used to derive corrections to the lunar tables, but Newcomb seems justly to question the validity of the results. The eclipses observed by the older astronomers and carefully recorded are of great value. And in later times the description of eclipses has been so accurately interwoven with even historical accounts as to furnish unquestionable data for chronology. The terror and apprehensive uncertainty associated with an eclipse in ancient times has given place to a lofty appreciation of the grand occasion and to a careful and inspiring scientific study of the phenomena.

The annexed table is a complete list of all the eclipses of the century having a total phase, however brief. The first column gives the date for the point on the earth where at noon the eclipse is central. The second column gives the Greenwich civil time of the conjunction of the sun and moon in longitude. The next column states the greatest interval in minutes during which the most favored place may experience the total phase. The fourth column gives the latitude and longitude of the place where the eclipse is central at noon. The last column indicates the areas traversed by the moon's shadow. Several of the eclipses, occurring in the polar regions, have no noon-point

and hence, for these, the place of the beginning or end of the eclipse, lowest in latitude, is placed in the fourth, and the corresponding time, sunrise or sunset, in the last column. The eight annular-total eclipses of the century are indicated by a *, and in these the duration of total phase may be but a few seconds. Two of the list, namely 1928 and 1967, are non-central in character, the moon's shadow just grazing the pole of the earth.

The Phenomena Observed in Total Solar Eclipses.— As totality approaches, a pale purple coloring spreads over the landscape. Within a minute of the total phase the phenomena begin to succeed each other so rapidly that no single observer can note them all. By those glancing at the landscape in the direction of the approaching shadow a majestic darkness will be seen to sweep forward with a swiftness truly impressive. Those looking at the earth, and away from the eclipsing sun, will see a succession of flitting bands, alternately dark and bright, known as the *shadow bands,* which for many decades remained an unexplained puzzle. About 15 seconds before the total phase, the moon, with its sharp irregular outline, due to the elevations and depressions in its surface, will have diminished the solar crescent to such an extent that the remnant of it usually begins to be crossed by black lines,— the mountains on the moon's edge connecting the limbs of moon and sun. Then it rather suddenly presents the appearance of a string of detached brilliant points, irregular in size and spacing. The appearance is due to irradiation which alike exaggerates the length and thinness of the projected lunar mountains and the size of the resulting bright points of the disappearing solar crescent. Totality, the appearance of the prominences, whether *red* or *white,* along the moon's edge, and the presence of the radiant, outspreading corona, are simultaneous. The phenomena of the earlier eclipses were recorded in the most general manner. Hasty drawings of the streamers of the corona, accompanied by descriptions reflecting but the dawn of scientific method, are the chief results. It was not until the application of the spectroscope and the photographic camera that the astronomer attained real insight into the stupendous phenomena.

The great eclipse of 8 July 1842 may be said to mark the beginning of serious and accurate attention to the complex physical features of total solar eclipses. Then the path of totality swept from Spain across France, Italy, Austria, Russia and central Asia and thus permitted many expert European astronomers to view and record the marvelous phenomena. It is noteworthy that in reports of this eclipse the red solar prominences were first described with precision, three large ones having been seen on the upper edge of the moon. The corona was also described as of a brilliant white luminosity and extending at least 15 minutes from the moon's edge. Among the many phenomena observed, the objects of special speculation were the newly discovered red flames or *protuberances* which Baily considered as "forming a portion of the corona," and Airy, who observed the eclipse through clouds, attributed to "some irregularity in the density of the cloud's edge."

During the total solar eclipse of 28 July 1851 both the corona and the prominences were observed in greater development than in 1842, and by several observers a scarlet *sierra* or reddish arc of light was noted near those parts of the lunar disc where the rays of the sun had disappeared, or else were about to appear. The observers for the most part became certain that the prominences were true solar appendages, because they were apparently uncovered by the moon's edge on the western edge of the sun, and extinguished on the eastern limb. A precious photographic achievement was the single successful daguerreotype taken by Barowski with a telescope of 2.4 inches aperture, attached to the Königsberg heliometer, and with an exposure of 84 seconds. It distinctly pictured the corona and several prominences, and thus became the first unchallenged record of these features of an eclipse.

It was, however, at the eclipse of 18 July 1860 which traced its total path across northern Spain, the Mediterranean and northeastern Africa, that photography was first applied with marked scientific success. Mr. Warren de la Rue and Padre Secchi each secured good representations of the prominences; the former also faint traces and the latter good portrayal of the corona. Comparison of these photographs set at rest, once for all, any doubt still existing as to the true solar character of the prominences. The photographic method of attacking the problems arising in total solar eclipses was from this time firmly established. Its progressive development was determined chiefly by three elements: First, increase in the sensitiveness of the plates; second, knowledge of the exposure time required; and third, necessary advancement in practical optics. The gelatin emulsion process introduced by Maddox in 1871, and given the touch of great sensitiveness by Bennett, in 1878, secured the first. Successive failure and success, coupled with scientific method in photometric study, brought the second. And, finally, refined theoretical discussion of the principles of optics as applied to celestial photography, coupled with marked improvements in optical manufacture, supplied the third. So that now by separate and regulated exposures, with specially designed instruments, either the outer long, delicate coronal wings may be pictured to an extreme limit, or the intensely brighter parts of the inner corona, shown with all their involved filaments and rich tracery, and with many a curious relation to the prominences and chromosphere.

The application of the spectroscope to the study of the brilliant red prominences during the total solar eclipse of 18 Aug. 1868 will always be memorable. Tracing its course across the Indian and Malayan peninsulas, and affording a total phase of more than five minutes and a half, this eclipse was spectroscopically observed by Janssen, Major Tennant, Lieutenant Herschel, Pogson and Rayet. The light of the prominences was recorded by each of these experts as consisting of several bright lines clearly indicative of the gaseous nature of those remarkable objects. The hydrogen lines C and F were certainly identified, and a yellow line, thence to figure famously in astronomy as D_3 and as due to *helium,* was too hastily assigned to sodium. Another notable result of this eclipse was the discovery by Janssen of a

TOTAL ECLIPSES OF THE SUN OCCURRING DURING THE TWENTIETH CENTURY

Date of eclipse, central at noon	Greenwich M. T. (Civil) of conjunction in longitude	Maximum duration of total phase	Locality of eclipse central at noon lat.	long.	Course of moon's shadow
	h m	m			
1901, May 18	5 38	6.7	2° S	97° E	Sumatra, Borneo, New Guinea.
1903, Sept. 21	4 30	2.3	70 S	101 E	Indian Ocean, Antarctic Ocean.
1904, Sept. 9	21 08	6.3	5 S	133 W	Polynesia, Pacific Ocean.
1905, Aug. 30	13 13	4.0	45 N	12 W	Canada, Spain, Egypt.
1907, Jan. 14	5 57	2.6	39 N	89 E	Russia, Chinese Empire, Siberia.
1908, Jan. 3	21 44	4.5	12 S	145 W	Polynesia, Pacific Ocean.
1908,* Dec. 23	11 49	0.4	53 S	3 E	South Atlantic Ocean.
1909, June 17	23 29	0.5	88 N	173 W	Siberia, Arctic Ocean, Greenland.
1911, April 28	22 26	5.4	1 S	155 W	Australia, Polynesia, Pacific Ocean.
1912,* April 17	11 40	0.2	46 N	1 W	Spain, France, Germany, Russia.
1912, Oct. 10	13 41	2.2	35 S	33 W	Ecuador, Peru, Brazil.
1914, Aug. 21	12 27	2.4	71 N	2 E	Scandinavia, Russia, Persia.
1916, Feb. 3	16 06	2.9	16 N	62 W	Pacific Ocean, Isthmus of Panama, Venezuela, West Indies.
1918, June 8	22 03	2.5	51 N	152 W	Pacific Ocean, United States.
1919, May 29	13 12	6.9	4 N	18 W	Peru, Brazil, Central Africa.
1921, Oct. 1	12 26	...	84 S	19 W	Antarctic Ocean.
1922, Sept. 21	4 38	6.4	12 S	106 E	Indian Ocean, Australia.
1923, Sept. 10	20 53	3.8	38 N	128 W	Pacific Ocean, United States, West Indies.
1925, Jan. 24	14 46	3.3	42 N	44 W	United States, Atlantic Ocean.
1926, Jan. 14	6 35	4.4	10 S	82 E	Central Africa, Sumatra, Borneo, South America.
1927,* Jan. 3	20 29	0.1	52 S	125 W	Pacific Ocean, South America.
1927, June 29	6 32	1.0	78 N	84 E	England, Scandinavia, Siberia.
1928, May 19	13 14	...	50 S	30 E	At sunset; Antarctic Ocean.
1929, May 9	6 32	5.5	1 S	89 E	Sumatra, Malay Peninsula, Borneo.
1930,* April 28	19 10	0.2	45 N	113 E	United States, Canada.
1930, Oct. 21	21 47	2.2	36 S	155 W	Pacific Ocean, Patagonia.
1932, Aug. 31	19 55	1.9	78 N	109 W	British America, United States.
1934, Feb. 14	0 44	2.0	19 N	168 E	Borneo, Celebes, Pacific Ocean.
1936, June 19	5 15	2.7	56 N	101 E	Greece, Russia, Siberia.
1937, June 8	20 43	7.3	10 N	131 W	Pacific Ocean, Peru.
1938, May 29	14 00	4.3	52 S	27 W	South Atlantic Ocean, Antarctic Ocean.
1940, Oct. 1	12 41	5.9	19 S	16 W	Colombia, Brazil, South Africa.
1941, Sept. 21	4 39	3.7	30 N	114 E	Central Asia, Pacific Ocean.
1943, Feb. 4	23 31	2.8	47 N	176 W	Yezzo, Pacific Ocean, Alaska.
1944, Jan. 25	15 25	4.4	7 S	49 W	Peru, Brazil, North Africa.
1945,* Jan. 14	5 07	0.0	51 S	108 E	South Atlantic Ocean, Indian Ocean.
1945, July 9	13 36	1.4	70 N	20 W	United States, Canada, Scandinavia, Russia.
1947, May 20	13 44	5.6	2 S	25 W	Argentina, Paraguay, Brazil, Central Africa.
1948,* May 9	2 31	0.2	44 N	138 E	Chinese Empire, Yezzo, Pacific Ocean.
1948, Nov. 1	6 03	2.2	37 S	82 E	Central Africa, Indian Ocean.
1950, Sept. 12	3 29	...	34 N	115 W	At sunset; Arctic Ocean, Siberia.
1952, Feb. 25	9 17	3.5	22 N	39 E	Central Africa, Arabia, Central Asia.
1954, June 30	12 27	2.7	62 N	5 W	United States, Canada, Scandinavia, Russia, Asia.
1955, June 20	4 12	7.3	15 N	117 E	India, Siam, Philippine Islands.
1956, June 8	21 30	4.9	40 S	141 W	South Pacific Ocean, Antarctic Ocean.
1958, Oct. 12	20 52	5.4	26 S	139 W	Pacific Ocean, Argentina.
1959, Oct. 2	12 31	3.3	23 N	6 W	Atlantic Ocean, Morocco, Central Africa, Abyssinia.
1961, Feb. 15	8 11	2.9	53 N	53 E	France, Italy, Austria, Siberia.
1962, Feb. 5	0 11	4.3	4 S	179 E	Borneo, Celebes, New Guinea, Polynesia.
1963, July 20	20 43	1.8	62 N	126 W	Alaska, British America.
1965, May 30	21 14	5.6	4 S	137 W	Pacific Ocean.
1966,* May 20	9 43	0.1	41 N	31 E	North Africa, Greece, Asia Minor, Central Asia.
1966, Nov. 12	14 27	2.2	38 S	43 W	Chile, Argentina, Brazil.
1967, Nov. 2	5 48	...	54 S	15 W	At sunrise; South Atlantic Ocean.
1968, Sept. 22	11 09	...	42 N	90 E	At sunset; Russia, Nova Zembla.
1970, Mar. 7	17 43	3.9	25 N	88 W	Mexico, Yucatan, Florida.
1972, July 10	19 39	2.8	67 N	111 W	Alaska, British America, Labrador.
1973, June 30	11 39	7.2	19 N	6 E	Venezuela, Central Africa.
1974, June 20	4 56	5.4	32 S	107 E	Indian Ocean, Southwest Australia.
1976, Oct. 23	5 10	5.0	31 S	95 E	Central Africa, Indian Ocean, Australia.
1977, Oct. 12	20 31	2.9	16 N	127 W	Pacific Ocean, Venezuela.
1979, Feb. 26	16 47	3.0	61 N	77 W	United States, British America.
1980, Feb. 16	8 52	4.4	1 N	48 E	Central Africa, India, Chinese Empire.
1981, July 31	3 53	2.2	54 N	127 E	Russia, Siberia, Pacific Ocean.
1983, June 11	4 38	5.5	7 S	111 E	Indian Ocean, Sumatra, New Guinea, Pacific Ocean.
1984,* May 30	16 48	0.0	38 N	74 W	Mexico, United States.
1984, Nov. 22	22 57	2.2	39 S	170 W	South Pacific Ocean.
1985, Nov. 12	14 20	...	52 S	146 W	At sunrise; Antarctic Ocean.
1986, Oct. 3	18 55	...	66 N	26 W	At sunrise; Arctic Ocean.
1987, Mar. 29	12 45	0.4	17 S	6 W	Atlantic Ocean, Central Africa.
1988, Mar. 18	2 03	4.1	28 N	146 E	Sumatra, Borneo, Philippine Islands.
1990, July 22	2 54	2.7	73 N	142 E	Russia, Nova Zembla, Arctic Ocean, Siberia.
1991, July 11	19 06	7.2	22 N	105 W	Mexico, Yucatan, Venezuela, Brazil.
1992, June 30	12 19	5.5	26 S	5 W	South Atlantic Ocean.
1994, Nov. 3	13 36	4.6	36 S	31 W	Pacific Ocean, South America, South Atlantic Ocean.
1995, Oct. 24	4 37	2.4	10 N	110 E	India, Malay Peninsula, Polynesia.
1997, Mar. 9	1 15	2.9	71 N	154 E	Central Asia, Siberia.
1998, Feb. 26	17 27	4.5	6 N	81 W	Pacific Ocean, Panama, Venezuela, Atlantic Ocean.
1999, Aug. 11	11 08	2.6	46 N	18 E	Germany, Russia, Chinese Empire, India.

* Annular total eclipses.

method by which the bright lines of the prominences could be observed apart from any eclipse whenever the sky was sufficiently clear. On the day following the eclipse he was able successfully to apply the new method; to demonstrate beyond controversy that the bright lines of hydrogen prevailed in the protuberances; and to make a third discovery always to be associated with this great Indian eclipse, namely, that of pronounced and rapid changes of form occurring in the prominences. Lockyer in England had for some time been at work on the same method for observing the bright prominence lines, and his final success was reported to the French Academy at the same meeting at which Janssen's achievements were announced. The coincidence was evidently rather determined by the progressive advancement of spectroscopic science than by accident. The spectrum of the corona of this eclipse was generally observed as a faint continuous one without lines dark or bright. Rayet, indeed, noticed a certain bright line near E as extending above the prominences. The polariscopic observations of Lieutenant Campbell and Captain Branfil proved that the coronal light was polarized in planes passing through the sun's centre. The inference thus seemed doubly plain that some solar light was reflected by the corona, although the absence of the dark Fraunhofer lines required explanation.

During the total eclipse of 7 Aug. 1869 spectroscopic observations established the existence of a bright green line crossing the continuous spectrum of the corona. It was at that time estimated as coincident with a bright chromospheric line of approximately the same wave-length, and the name *Coronium* was given to the element from which the light which was the source of the line came. The photographic records of the powerful spectrographs applied to the eclipses of 1896 and 1898 furnished data, however, which definitely separated coronium from its neighbor in the chromosphere.

The eclipse of 22 Dec. 1870 was of particular interest to the American observers who had studied that of 1869. This resulted in the despatch of two large parties to Europe, one directed by the United States Naval Observatory and the other by the officers of the Coast Survey. If there remained any doubt as to the gaseous nature of the inner corona it was to be dissipated by the fine drawing and description of the inner corona furnished by Professor Watson of Ann Arbor, stationed at Carlentini, Sicily, and observing this gaseous shell to an elevation about 5 minutes; and by Professor Young's observations in Spain of the now familiar green line of coronium, visible plainly in this area, and traceable as far as 16 minutes from the solar limb. This eclipse will always be peculiarly famous for Professor Young's discovery of the *reversing layer* as a thin shell lying immediately above the photosphere. The existence of this reversing layer has since 1870 been repeatedly verified visually, and more recently by photographic records. It comprises an envelope of glowing vapors of an estimated depth of about 600 miles lying at the base of the chromosphere. Its thinness causes the bright lines to appear for but a few seconds, or as a brief *flash*, unless the observation be made at some station near the edge of the lunar shadow.

The eclipse of 12 Dec. 1871, whose path lay across southern India, and northern Australia, was photographed according to a consistent plan, and photographs were subsequently studied with consummate skill and the delicate results reproduced in detail with masterful accuracy. (Vol. XLI, 'Memoirs Royal Astronomical Society.') Here for the first time was available a representation of the corona in all its complex glory of spaced polar rays, dark rifts, filaments straight, curved, and interlacing, and of stupendous *synclinal* structures with rich nebulous mottling. The delicate portrayal of the wet-plate process was only equaled by the scientific and artistic manner in which the results were integrated.

The eclipse of 16 April 1874 was visible only in southern Africa, and observed at Klipfontein by Mr. E. J. Stone, the astronomer royal of the Cape Observatory. He confirmed Young's observation of the reversal of the Fraunhofer lines near the photosphere, and traced the main, green coronal line to more than a degree from the moon's edge. The corona exhibited extended equatorial wings, covering in some parts more than three lunar diameters. The spectroscopic character of the corona, and its unchanged features, as viewed from different stations in Africa, led Stone to insist on the solar origin and cosmical nature of the outer corona.

The path of the total solar eclipse of 29 July 1878 lay diagonally across North America from Bering's Strait to the Gulf of Mexico, and afforded a memorable opportunity to many American and foreign astronomers. The direction of the line of totality across the Rocky Mountains permitted several astronomers to observe the phenomena at extraordinary altitudes. Langley on Pike's Peak, at an altitude of 14,100 feet, traced the corona in the direction of the ecliptic for a distance of at least 12 lunar diameters, and felt great confidence in saying that this, though covering a range of over 10,000,000 miles, was "but a portion of its extent." The polar rays and filaments of the inner corona received careful study from such experienced observers as Ormond, Stone, Boss, Paul, Trouvelot and Upton. The dry-plate photographs obtained by Professor Hall's party at La Junta, and by Professor Harkness' party at Creston, were in remarkable agreement as to the details of the inner corona, the same intensities of shading, to great delicacy, being in common, and the pronounced filamentous character of the polar rays, as well as the marked curvature and brightness of the equatorial extensions being clearly shown in both sets of plates. It was the concurrent opinion of many observers that although the corona exhibited vast wings, it lacked, particularly in its inner portions, the brilliancy of the corona of 1869. As to the spectroscopic observations, the gaseous corona manifested, as it seemed, a pronounced sympathy and intimate relation with the 11-year sun-spot period, giving faint spectroscopic lines at the minimum, 1878, and brilliant ones at the maximum, 1869, 1870, and 1871, of the period. It was also discovered that a greater development of the corona in the equatorial than in the polar regions is one of

the characteristics of coronas which have been observed during periods when there were few sun-spots.

Thus, during total eclipse of 17 May 1882 the photographs of the corona reproduced the form which it had in 1871, near a sun-spot maximum, being most extended at points away from the solar equator and with no special structure at the poles. It was thus distinguished from the coronas of 1878 and 1867: near sun-spot minima, which were greatly elongated along the sun's equator and of marked structure at the poles.

During the eclipse of 29 Aug. 1886 Prof. W. H. Pickering, of the Harvard College Observatory, made a valuable investigation on the photographic photometry of the corona, the result of which led Holden to employ a similar method in the two eclipses of 1889. The values obtained by these two observers are stated in the following table. From this eclipse also, a study of the largest prominence of the eclipse, which rose in a somewhat spiral form to the altitude of 150,000 miles, the Italian astronomer Tacchini was enabled to verify the discovery of *white* prominences and immediately announced to the Academy of the Lincei at Rome: "That during a total solar eclipse of the sun there may be seen most beautiful prominences not visible in full sunlight; that the prominences visible only during totality are white, especially in their more elevated parts, and have a special filamentous character, the threads being thin, long and blunt at the top; that the luminous intensity of the white prominences is feeble, and for this reason they are not visible to the naked eye, unless their height surpass that of the more brilliant parts of the corona; and that the other prominences visible in full sunlight appear much wider and higher in a total eclipse, and, when of a considerable height, have their summits white."

Photographic photometry of the solar corona	August 1886 Pickering	January 1889 Holden	December 1889 Holden
Intrinsic actinic brilliancy of the brightest parts of the corona	0.031	0.079	0.029
Ditto of the polar rays	.....	0.053	0.016
Total actinic light of the corona	37.	60.8	26.2
Ratio of total coronal to total sky light (actinic)	1 to 1400	1 to 3043	1 to 1285
Ratio of intrinsic brilliancy of the brightest parts of the corona to that of the sky (actinic)	44 to 1	16 to 1	32 to 1
Magnitude of the faintest star shown on the eclipse photographs	.....	2.3	.....

The total eclipse of 1 Jan. 1889 was visible in a path that lay across California and Nevada, and was successfully observed by many American astronomers. The photographs taken are notable alike for the fine detail of the inner parts of the corona registered, and for the immense extent of the streamers imprinted. A particularly fine negative by Barnard permitted Holden to trace rays similar in typical character to the polar rays all around the limb of the sun and to present a detailed study of the filamentous character of the corona. An interesting feature of several of the photographs consisted in their showing the outline of the moon's black disc projected on the corona before totality had begun.

From a study of his photographs of this eclipse and of the following total eclipse four years later, Professor Schaeberle deduced his 'Mechanical Theory of Solar Corona' — that the corona is caused by light emitted and reflected from streams of matter ejected from the sun, the stream lines of the corona coinciding with elliptical areas having one focus at the sun's centre, the origin of the streams being, in the main, confined to the spot-zone regions. Professor Schaeberle applies his theory to the location of half a dozen solar areas productive of the actual streamers photographed in the eclipse of 1893. Whatever the merit of the particular theory, it has had the advantage of pointing out the importance of dynamical and spatial study of the coronal streamers.

In the eclipse of 16 April 1893 it was shown that the lines of hydrogen and helium, seen hitherto in the corona by a number of observers, must be attributed to a scattering of the prominence light by the earth's atmosphere and possibly by the corona itself, but not to the intrinsic coronal light. An attempt was also made to determine the rotation of the corona by photographing its spectrum on both sides of the sun; the H and K lines only were employed and a speed was found almost equal to that of the solar surface and corresponding to a distance of 20 minutes from the limb.

The eclipse of 9 Aug. 1896 was visible in its total phase in Norway, Nova Zembla and northern Asia, while the path of the following eclipse, that of 22 Jan. 1898, lay across east central Africa, India and the Chinese Empire. Each of these eclipses was successfully observed by a great number of astronomers and furnished a great wealth and variety of photographic material. In the second eclipse Campbell, of the Lick Observatory, employed an objective-grating spectograph which was so arranged as to give a continuous photographic account of the changes in the solar spectrum at second and third contacts. Many interesting results of differences of level and of intensity of radiation in the lines were obtained. The photographs obtained by Campbell with a lens of 40-feet focal length showed also a great wealth of detail. One of two seconds' exposure clearly indicates the ultimate relation of the prominences with the synclinal structure of the corona; another, of eight seconds, gives a fine representation of the polar rays and rifts with a coronal form already clearly influenced by the approaching sun-spot minimum.

The total solar eclipse of 28 May 1900 will always be famous for its long course through civilized territory, its path crossing the United States from Texas diagonally to Virginia, and finally threading its way across Spain. It is

chiefly memorable for the fine weather which prevailed along the track of totality and for the magnificent array of optical and physical appliances employed in its observation. The chief American parties were those of the Lick, Yerkes, Allegheny, Smithsonian, Princeton, Brown, Harvard and United States Naval observatories, conducted respectively under the direction of Campbell, Hale, Wadsworth, Langley, Young, Upton, W. H. Pickering and S. J. Brown. Long focus telescopes either directly pointed at the sun or fed by cœlostats for coronal photography, huge Rowland grating spectrographs for photographing the flash and the delicate bolometric appliances of Hale and of Abbot characterized the instrumental attack. A great prominence was seen in the southwest quadrant, whose white summit was in eruptive activity. Striking changes in this prominence and in others were seen on comparing the American photographs with those taken at Ovar, Portugal and in Spain about two hours later. The study of the form of the corona as presented by the photographs was of special interest as a test of a "polarization theory" of its streamers developed by Bigelow some 10 years previously. According to this theory the coronal lines should lie in the direction of the lines of force surrounding a spherical magnet. Such magnetization of the sun, although suggested, was then not necessarily assumed. The progress of physical science later made it probable that matter on the solar surface was electrically ionized after the manner of the cathode streams of the Geissler tubes. And these electrified particles, or electrons, require then only to be directed by a supposed magnetic field of the sun. Bigelow's "Magnetic Theory of the Corona," supported by Eberts' experiments, seems likely both from the natural assumptions made, and from the deductions allowable, to furnish the master-key to the mysteriously definite arrangement of the corona at the sun's minimum of activity.

The spectroscopic observations were manifold and in the main successful. Professor Evershed, observing in Algiers, just outside of the path of totality, obtained photographs of the flash spectrum in high solar latitudes, and concluded that, in its main features, it is the same as in low latitudes. He verified the essential identity of the flash spectra as photographed by Shackleton in 1896 and those obtained in 1898 and 1900, and inferred that "the flash spectrum is probably as constant a feature of the solar surface as in the Fraunhofer spectrum." In discussing the detailed spectroscopic results of the flash layer, Evershed infers that the abnormal intensities of the enhanced lines characteristic of all levels and all latitudes of the flash is due to a continuous circulation of the solar gases in a radial direction, while the cooler, more diffused gases, in their subsidence, determine the character of the absorption spectrum. His final conclusion is "that the flash spectrum represents the emission of both ascending and descending gases, while the Fraunhofer spectrum represents the absorption of the descending gases only." Professor Deslandres, by means of spectrographs with optical parts of Iceland spar and quartz, photographed the entire ultra-violet spectrum of the reversing layer from λ 4000 to λ 3000, the entire ultra-violet spectrum of the upper chromosphere and the entire spectrum of the corona with two new coronal rings. Deslandres, observing visually with a powerful grating, inferred from the inclination of the green coronal line on the east side of the equator that the corona appeared to have a more rapid rotation than the disc. Professor Turner secured photographs, in polarized light, of the corona, permitting of a quantitative investigation. The polarization of the corona was radial and was "not only shown in the outer streamers, but right up to the moon's limb." An important bolometric measure of the heat of the corona was conducted by Abbot and Mendenhall, of the Smithsonian Observatory, which led to the conclusion that the corona neither reflects much solar light nor in the main gives light of its own on account of high temperature, "but seems rather to be giving light in a manner not associated with a high temperature, or at least with the preponderance of infra-red rays usual in the spectra of hot bodies." This result plainly points to the electrical character of the coronal light and is also in harmony with Bigelow's magnetic theory. Deslandres, using "a very sensitive Melloni pile" for detecting the heat of the corona, reports positive indications which are in strange contradiction with Abbott's results and intensify the regret at the accident which befell Hale's bolometric appliances at the critical moment. The heat measures in future eclipses will have a great interest in relation to coronal theory.

The total eclipse of 18 May 1901 traced its path across southern Madagascar, the Indian Ocean, Sumatra, Borneo, the Celebes and New Guinea, and, on account of its long duration of over six minutes and the high altitude of the sun at the best points of observation, attracted expeditions from many countries. The general weather conditions unfortunately proved to be unfavorable; at a few of the eclipse stations, however, observations of great value were made. Professor Perrine, observing at Padang, Sumatra, through a partly clear sky, obtained excellent results. His photographs showed "conspicuous series of coronal hoods," and also "a remarkable coronal disturbance resembling an inverted cone of considerable angle" and unlike anything previously recorded. This disturbance associated with a long thread-like prominence, Professor Perrine, subsequently, by means of the Greenwich solar negatives taken at Dehra Dûn, India, traced to a sun-spot and associated faculæ, near the solar limb on the day of the eclipse, and thus plainly exhibited faculæ, prominences, coronal disturbance, and sun-spots in a common origin and intimate relation. This wonderful phenomenon was without doubt due to a solar eruption which took place near the solar limb and at, or just prior to, the time of the eclipse. The photographs of Mr. Peters, of the United States Naval Observatory, taken at Fort de Kock, Sumatra, confirm Perrine's results as to the formation of hoods and envelopes above some of the prominences, and are replete with structural detail. The corona, according to Perrine's photographic negatives, was polarized in the portions 10 minutes beyond the solar limb in all position angles including the polar regions. In negatives of the English astronomer, Newall, some of the streamers showed greater extension in the polarized than in the unpolarized light. In the special work

on the corona contemplated by Professor Barnard's long exposure of a very large plate, and by Dr. Abbott's second attempt to measure the coronal heat bolometrically, there was universal interest among astronomers and universal regret at the compulsory postponement to a future eclipse on account of the clouds. A photographic search for an intra-Mercurial planet was conducted by Perrine using four lenses covering a stretch of 19 degrees on either side of the solar equator. The faintest stars on the plate range from 6.5 to 9.3 visual magnitude, and Perrine infers that "unless at the time of the eclipse the planetary bodies were directly in line with the sun or with the brightest portion of the corona, there is no planetary body as bright as 5.0 visual magnitude within 18 degrees of the sun, whose orbit is not inclined more than 7¼ degrees to the plane of the sun's equator."

In the total eclipse of 30 Aug. 1905, the shadow swept over the earth from central British America, across Labrador, France, Spain and northern Africa, finally leaving the earth at southeast Arabia. This was a very favorable eclipse, the maximum duration being nearly four minutes, and the path of totality unusually accessible. For these reasons, great numbers of parties were organized to observe it, no less than 80 stations being established. It was hoped that a comparison of photographs taken toward the west end of the path with those of Spain and Arabia, taken nearly two and one-half hours later, would throw much light on the changes of the corona during this interval and upon the alteration in appearance of it and of the chromosphere due to the rotation of the sun. Unfortunately it was cloudy in Labrador, but hundreds of beautiful photographs were taken from stations in the Old World. Fabry during this eclipse made a careful determination of the total light emitted by the corona and found that altogether we receive from this object almost exactly as much light as from the moon when this is full.

The shadow in the eclipse of 21 Aug. 1914 swept from the northern boundary of North America across eastern Europe to India. Several parties were formed to observe this eclipse, notwithstanding the very unsettled condition of the countries through which the shadow passed, but the results were, very unfortunately, almost nothing, due to cloudy weather. It was planned to test from this eclipse for the first time the new theory of Relativity, according to which a ray of light passing through a gravitational field should suffer a minute deflection. The measurement of this deflection seems at present to be about the only physical observation which can be made to test the theory, though even with a star which appears at the edge of the sun the deflection should amount to but ninety-three hundredths of a second, and to less than four-tenths of a second for a star 20 minutes away. If found, a deflection would be complicated by the refraction of the rare matter of the corona, the density of which in different portions was also to be investigated by photometric methods.

The eclipse of 8 June 1918 was of special interest to astronomers in the United States because the path of totality extended entirely across this country in a diagonal direction from Washington to Florida. The duration of totality exceeded two minutes in Washington, but this time diminished to less than one minute in Florida, and as the sun was very low in the west when the eclipse occurred to Eastern observers, nearly all eclipse parties were stationed in the far Western States. Owing to world conditions, these were exclusively American. Observers from the Allegheny Observatory, the Chamberlain Observatory, the Lowell and Sproul observatories, the observatory of Drake University and others were located in Colorado; from the Mount Wilson Solar Observatory and from the Yerkes Observatory, the parties were in Wyoming, while the party from the Lick Observatory (whose elaborate instruments, employed in the eclipse of 1914, were still detained in Russia), were in Washington. The party farthest east was from the Smithsonian Astrophysical Observatory: this located in Kansas in order to ensure the spreading out of observers along the path as much as possible and so to increase the chance of avoiding bad seeing, which might be purely local. Observations were made for determining the rotation of the corona, while photometric measures of its light and many photographs of its form were obtained, the weather being favorable almost throughout the entire path. Photographs were also secured to test the theory of relativity, but the results of this work cannot yet be given.

Bibliography.—The general theory of eclipses and the methods for their computation have been developed by Bessel in the 'Astronomische Nachrichten,' Nos. 151 and 152, but with the utmost rigor in his 'Astronomische Untersuchungen' (Vol. II); a full development of Bessel's method is given in Chauvenet's 'Spherical and Practical Astronomy' (Vol. I), and in 'The Theory of Eclipses' by Roberdeau Buchanan. The most reliable general tables for the computation of eclipses are those of Newcomb, 'Astronomical Papers of the American Ephemeris' (Vol. I). Oppolozer's 'Canon der Finsternisse,' published as Vol. LII of the 'Denkschriften' of the Vienna Academy contains the elements of 8,000 solar and 5,200 lunar eclipses occurring between the dates —1207 Nov. 10 (Julian) and 2161 Nov. 17 (Gregorian), and the accompanying charts show the approximate path of each eclipse on the earth's surface. A valuable accessory to Oppolzer's 'Canon' is found in Dr. R. Schram's 'Tafeln zur Berechnung der näheren Umstände der Sonnenfinsternisse,' published in Vol. LI of the Vienna 'Denkschriften.' Ginzel, in the 'Sitzungsberichte' of the Vienna Academy, LXXXV, LXXXVII and LXXXIX, and in his 'Spezieller Canon der Finsternisse,' published by the Berlin Academy, has brought together a large array of references to ancient eclipses and compared them with computation. The papers of Airy, Williams, Maguire and S. J. Johnson in the *Monthly Notices* of the Royal Astronomical Society are of interest. The physical data and problems of total solar eclipses are treated in a vast modern literature mostly issued by the observatories and learned societies. A highly important compend of physical information concerning total solar eclipses is that of Ranyard, 'Memoirs of the Royal Astronomical Society' (Vol. XLI). For the

later eclipses the most valuable discussions are to be found in the publications of the United States Naval, Harvard, Lick, Yerkes and Smithsonian observatories, in the 'Astronomische Nachrichten,' the 'Memoirs' and the 'Monthly Notices' of the Royal Astronomical Society and in the *Astrophysical Journal*.

Revised by ERIC DOOLITTLE.

ECLIPTIC, in astronomy, the sun's path, the great circle of the celestial sphere, in which the sun appears to describe his annual course from west to east. The constellations on the ecliptic give their name to the 12 signs of the zodiac (q.v.), each of which covers 30 degrees. The Greeks observed that eclipses of the sun and moon took place near this circle; whence they called it the *ecliptic*. The sun does not always rise to the same height in the meridian, but seems to revolve round the earth in a spiral, and is in the equator twice a year, about 21 March and 23 September. The points of the equator in which the sun is on these days are at the intersection of the equator with the ecliptic. On 21 June the sun reaches its greatest height in the heavens, and 21 December it descends the lowest. The position of the equinoxes on the ecliptic is changing about 1 degree 24 minutes per century. (See EQUINOX). The ecliptic has two poles, 90 degrees from it, which appear to revolve about the north and south celestial poles, respectively, every 24 hours. What appears to be the path of the sun, however, is in reality the path of the earth. The planets and the moon revolve in different planes; but these are inclined at only a very small angle to the plane of the ecliptic; hence these bodies can be but a small distance from the ecliptic. The plane of the ecliptic is very important in theoretical astronomy, because the courses of all the other planets are projected upon it and reckoned by it. By the obliquity of the ecliptic we understand its inclination to the equator, or the angles formed by the planes of these two great circles. This angle is measured by the arc of a third great circle, drawn so as to intersect the two others perpendicularly, in the points at which they are farthest apart. The ancients endeavored to measure the obliquity of the ecliptic. According to Pliny, it was first determined by Anaximander. The most celebrated measurement of this obliquity in ancient times was made by Pytheas, at Marseilles. He found it, 350 B.C., to be 23 degrees 49 minutes 23 seconds. A hundred years later, according to Ptolemy, Eratosthenes found it to be 23 degrees 51 minutes 13 seconds. In 1900 the obliquity was 23 degrees 27 minutes 8 seconds; it is diminishing at the rate of nearly half a second a year and is expected to reach a minimum value of 22 degrees 15 minutes in about 15,000 years. It will increase thereafter to about 25 degrees. See DAY; NUTATION.

ECLOGITE, ĕk'lō-jīt, or **EKLOGITE,** a crystalline rock composed of the grass-green amphibole called smaragdite and red garnet. Another variety of eclogite is composed of omphacite, a grass-green granular variety of pyroxene and garnet. Eclogite is not an abundant rock; it is usually associated with the older crystalline schists, but as a rule is not itself schistose. It is found in Norway, Greece and in parts of the German Empire.

ECLOGUE, ĕk'lŏg, in poetry, at first a term applied to a section of choice poems. Later the word, from its application to the collection of Virgil's pastoral poems, the 'Bucolica,' came to connote a pastoral composition, in which there is a dialogue between two or more shepherds; and thence, more loosely, any short, highly finished pastoral poem. See LITERARY FORMS.

ÉCOLE DES BEAUX-ARTS, ā-kōl-dā-bōz-ār' (School of Fine Arts), the French government school at Paris, officially called the École Nationale et Speciale des Beaux-Arts de Paris. In 1648 Mazarin, under the patronage of Louis XIV, founded the Academy of Painting and Sculpture, and in 1671 Colbert completed Mazarin's work by establishing the Academy of Architecture with its school. The two schools were united under their present title in 1793, although lessons in architecture had actually been given at the former school by François Blondel as early as 1671. Competition for the Grand Prix de Rome was instituted in 1666, and the same year witnessed the establishment of the Collège de France at Rome by Colbert and Charles Errard. In 1819, the school received its charter, the administration being left in the hands of the Académie des Beaux-Arts. In 1863 it was taken from the control of the Institute and placed in the charge of a government official, since when the management has remained practically the same.

The school is free to men and women from the ages of 15 to 30 and the courses extend over a period of 8 to 10 years, generally Courses are given in painting, sculpture, architecture, copper-plate engraving and engraving of medals and precious stones; and supplementary classes are held in drawing (both from the antique and living model), building, architecture (theory and history), design, decoration, history of art, æsthetics, general history, geometry, perspective, science, etc. There are severe examinations for entrance and, likewise, competitive examinations which are held every six months. This competitive system governs the grading of all pupils. In addition to more or less regular attendance at these regular courses, the students work in the various ateliers, or studios, under different professors, to whom they are obliged to pay a small fee.

The location of the school is at the old convent of Petit Augustin, between the rue Bonaparte and the rue Saints-Pères. The present Palais was designed by Debret and enlarged and completed by Felix Duban, the construction being finished in 1863. Opportunities for study are found in the splendid collections, which include all the works which have been awarded the Grand Prix, numerous portraits of the professors, classical copies and originals and valuable drawings by the old masters. The library, whose origin dates from the beginning of the school, is rich in valuable books, engravings and photographs. Statistics show some 2,000 students (1913) and 50 teachers (including those in the ateliers). The governing board and administrator are selected from among the best artists of France.

American students are predominant among the foreigners at the school and American architecture has been greatly enriched as a result of their training. The Congressional Li-

brary, Washington, D. C., the Tribune Building, the University Club and the new model tenement dwellings in New York city, besides numerous palatial residences throughout the country, testify to the practical knowledge and artistic skill of the French-trained American architects. (See INSTITUTE OF FRANCE). Consult the "Beaux Arts Number" of the *Architectural Record* (New York, January 1901); Delaborde, 'L'Academie Royal de Peinture et de Sculpture, Etude historique' (Paris 1861); Lenoir, 'Histoire des arts en France' (ib. 1895).

ECOLOGY, that phase of biology that considers plants and animals as they exist in nature, and studies their interdependence, and the relation of each kind and individual to its environment. It is the study of the actions and interactions of living things, and their reactions toward external influences. Although there always have been observers of organic nature, and collectors and recorders of facts — the material for the generalizations of biology — this information has for the most part consisted of isolated facts only slightly correlated with the circumstances surrounding each case: and it has rarely been studied in the light shed by other sciences, as chemistry, meteorology, geology, etc., on the physical processes attending growth, individual success and group-development in nature. It is in this wide, synthetic method that ecologists seek to work, including in any problem all the influences that combine to produce and modify an animal or a given fauna, and thus to account for its existence and peculiarities in the place where it is found. Ecology, then, is more than merely a study of life-history, or of habit and behavior, for it seeks to ascertain and interpret the causes of, and reason for, observed facts by gaining a knowledge of the complex influences to which the animal or plant in question is exposed, and the nature of its reactions.

It is only within recent years that this field of study has been recognized in its full value, and scientifically utilized, but the very illuminating results obtained have converted to it many naturalists who were at first openly skeptical of its practical value. The American Ecological Society now contains more than 300 members, and in many universities and museums formal instruction in ecological methods is now given to students of zoology and botany. An excellent account of the subject, by Prof. Charles C. Adams, may be read in the *American Museum Journal* (Vol. XVII, November 1917, pages 491–494).

ECONOMIC GEOLOGY. Economic geology is that branch of geology which treats of the distribution, mode of occurrence, mineralogic content and origin of the economically valuable mineral substances occurring within the earth. The most generally recognized classification of these is into non-metallics and metallics. With the non-metallics are classified all those substances that are not metals in the form in which they are used. Clay, for example, is placed with the non-metallics, though it contains the metal aluminum. All those substances used directly for their metal content are classed with the metallics, such as ores of lead, iron, etc.

Non-metallics.— Following are listed the more important members of this group. The natural fuels include coal, peat, petroleum and natural gas. Important building stones are granite, marble, slate, sandstone and limestone. Clay and cements may be included under materials of construction. Salt, borax, potash and related compounds are considered under the head of salines. Closely related to these is gypsum. The fertilizers include apatite, rock phosphate, marl, greensand and potash. Among the abrasives are novaculites, corundum, emery, grindstones, pumice and volcanic ash, tripoli, garnet and quartz. The gems or precious stones include diamond, emerald, beryl, garnet, opal, ruby, sapphire, peridot, topaz, turquoise and many others. Minor unclassified non-metallics embrace asbestos, barite, diatomaceous earth, feldspar, fluorite, fuller's earth, glass sand, graphite, magnesite, mica, monazite, sulphur, soapstone, talc, water and numerous others of lesser importance. See ABRASIVES; BUILDING MATERIALS; COAL; CORUNDUM; DIAMOND; PETROLEUM; SLATE.

Metallics.— The major metals are iron, copper, lead, zinc, gold and silver. Minor metals include aluminum, cobalt, manganese, mercury, nickel, platinum, tin, tungsten and many more. See COPPER; IRON; TUNGSTEN, etc.; also ORE DEPOSITS; PLACERS; MAGMATIC SEGREGATION; VEIN, etc.

Each of the above substances is treated in a separate article which includes the mineralogy and geology of the product.

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ECONOMIC HISTORY. It is a truism that each generation must rewrite the history of the past for its own study. This is because each generation views with particular interest those aspects of life and progress in the past which are of greatest present importance. From the 15th to the 18th centuries men were primarily interested in religious questions and the history written during that period was tinged with theological controversy. During the latter part of the 18th and the greater part of the 19th centuries the formation and development of constitutional government claimed chief attention, and history was written over again from this standpoint. To-day, especially in the United States, our interests have grown to be preponderantly social and economic, and the result is that emphasis is now being laid upon what is called economic history.

By this is not meant what is generally termed the economic interpretation or the materialistic conception of history, which holds that economic factors alone can furnish an adequate explanation of human development. This doctrine of economic determinism was set forth with great force by Karl Marx and has been generally accepted by other socialists. According to them economic activity is the fundamental condition of all life, and consequently all changes in the development and structure of society, whether intellectual, religious, social or what not, must be traced in the last analysis to purely economic causes. Few writers hold this view and it must not be confused with the recent development of economic history.

Writers other than the Socialists assign, indeed, a much humbler rôle to economic history than that of such a comprehensive explanation of all social phenomena. According to some its chief mission seems to be to hunt up illustrations which the economic theorist may then use to illustrate principles which he has deduced without recourse to historical evidence. Others admit that it is often useful to test the limits of the actual applicability of theoretical economic doctrines. While still another group, notably the German historical school of economics, hoped that by the use of historical research they could establish new economic truths of a theoretical character, arrived at by the inductive method. This last hope has on the whole proved fallacious and the economic historian to-day is content with a less ambitious program than the complete reconstruction of economic science.

What then is economic history? It may be defined as an explanation, as complete as may be, of the economic life of a period. Such an explanation is very difficult and for certain periods all but impossible, because of two facts. The first is that the records of the past in so far as they concern economic phenomena — the everyday business of earning and spending one's income — are very meagre; and the second is that the Industrial Revolution (q.v.) so completely changed the course of economic development that even a complete explanation of the past throws little light upon present problems. Economic history is more than a narrative, or an account of an industry or an institution; it is an economic analysis and causal explanation of the facts and their interrelations. Such an explanation is not easy, for economic life is very complex; economic phenomena are never isolated, but work together. The special task of economic history is thus a reasoned explanation of causes and tendencies.

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ECONOMIC THEORIES OF LABOR. See LABOR.

ECONOMICS. Economics may be defined as the science of the production and distribution and consumption of wealth. It is concerned with the activities of man in the process of earning a living and of applying his income to the satisfaction of his wants. As a science economics is scarcely more than a century old, but economic phenomena must have attracted attention and caused reflection as long as thinking beings labored to gain a living. At first economic thought was inchoate and confused, finding expression chiefly in the moral codes of priestly lawgivers. And when economic doctrines began to be differentiated from moral or political precepts, they were still conditioned by the religious, industrial and social environment in which the thinker lived. With every important social change new economic theories have arisen which have sought to explain the existing situation. Hence economic progress has been accompanied with the development of economic thought and the rise of new theories. And as society came to be organized primarily for economic rather than for military or religious purposes greater attention has been directed to economic problems and to their theoretical explanation. The development of thought shows a progressive comprehension of economic phenomena and a steady development in scientific treatment. To understand the scope and content of the science of economics to-day we cannot do better than to trace its historical development.

Ancient Thought.— The earliest expressions of economic thought are to be found in the moral codes of Oriental peoples, of which the Mosaic and Brahminic codes may serve as illustrations. These were primarily religious and economic concepts and were completely dominated by theological considerations. Spiritual perfection was the end to be achieved and economic well-being or poverty were held to be ordained by divine will. Everyday life was minutely regulated; custom ruled and change was avoided; the individual was entirely subordinated to society. Under such circum-

stances there was little opportunity for the development of economic progress or of economic theory.

While the Greeks resembled the Oriental people in their confusion of economics with morals, in conceding the dominance of ethical motives and in emphasizing the importance of the state, they yet appreciated more fully the importance of material wealth and analyzed the nature of economic wants more carefully. It has been said that every one is a follower of either Plato or Aristotle, the two leading Greek philosophers. Plato described an ideal state in which the individual is completely subordinated to the state, community of property and of wives and children is established, population is regulated. Aristotle opposed this extreme communism, approved of personal freedom, private property and individual initiative. His analysis of economic activities was rational in contrast with the metaphysical Oriental speculation or the idealism of Plato and marked a considerable advance in economic method.

There was little advance made by Roman writers. As their interests were military and political, industrial activities were regarded as ignoble — with the exception of agriculture — and consequently little thought was directed to these subjects. The chief writers who directed their attention to economic matters were Cicero, Cato, Varro and Columella, but all of them concerned themselves rather with technical advice about agriculture and laments at its decline than with national economy. In general the Romans followed the Greek writers. Their chief contribution lay after all in the development of the science of jurisprudence.

The slight development of economic thought in antiquity was due to several reasons. In the first place practical economic activities were not far developed. War absorbed a great part of the energy of the people. Agriculture was rude, manufacturing and commerce were in a still more primitive state. Owing to the insecurity of life and property there was little incentive to or possibility of the accumulation of capital. The system of slavery, upon which all ancient societies were based, led to a contempt for labor and prevented real economic progress.

Mediæval Thought.— The ill-defined period known as the Middle Ages (400–1500) was one of transition and adjustment. After the downfall of Roman civilization there was a stormy period in which Roman institutions, Christian theology and Germanic customs were blended into a new catholic ecclesiastical and civil system, followed by another period in which the Western world had to defend itself against the invasions of Eastern nomadic tribes. From the 11th to the 15th century the typical mediæval institutions of scholasticism and feudalism developed and dominated life and thought. Throughout most of this period society was disorganized and broken into fragments. The typical economic unit was the independent domestic economy, self-sufficient and practically without intercourse with the outside world. Agriculture was the main and in fact almost the only industry, domestic manufactures being confined to supplying local wants, and commerce was practically unknown for all but river or seaport towns. There was, however, during the later Middle Ages a transition from this domestic economy to a broader town economy, if not to a national economy. Manufactures and commerce encroached gradually upon agriculture; the ancient institution of slavery was modified into serfdom. Feudalism, however, prevented any considerable economic advance, as its chief office, which must be recognized as beneficent in the chaotic conditions of the times, was to preserve order and defend existing institutions.

Under such circumstances but little contribution could be expected to the world of economic thought. Men's speculations during this period were primarily theological and economic doctrines were controlled by religious considerations. The best exposition of the economic theory developed during the Middle Ages, if we may designate as theory a body of rules of conduct, is to be found in the canon law. Based upon a mass of ecclesiastical legislation and decisions, this was codified in the 12th century. Prescribing as it did rules of right conduct and of atonement for wrong, it necessarily made inquiry into economic relations and activities. The keynote of the economic doctrines may be found in the conception of a just price; this was determined by the cost of production, but to the canonist cost was measured only by the labor involved, as there had not yet developed an adequate conception of capital as an agent of production. A just price then was one that secured a fair return to the worker. Similarly, because of their lack of appreciation of the rôle played by capital in production, they condemned usury or the taking of interest, though this doctrine came to be modified with the growth of trade. But avarice, the pursuit of wealth as an end in itself, was condemned as one of the seven deadly sins. This stands in strange contrast with the modern conception of self-interest as the motive power of economic action. Manifestly there could be no great development of economic activity or of theory so long as such conceptions prevailed.

The Middle Ages were followed by a period of two or three centuries marked by profound change in the world of economic enterprise and by the rise of new ideas in the world of economic thought, which paved the way for modern systems of industry and theory. In this transitional period we may distinguish two systems of thought or of policies, namely, Mercantilism and the Physiocratic system. The first of these was a body of economic policies rather than of theory, but the second comprised a coherent system of thought.

Mercantilism.— By Mercantilism is meant the prevailing economic views entertained by European statesmen from the 16th to about the middle of the 18th century. These concerned themselves mostly with money and foreign commerce and were the result of the new economic forces that were making themselves felt in the world. Foremost among these was the importation of gold and silver from America, which facilitated the change from payment in services and kind to a money economy, and helped to break up the old feudal régime. The growth of court expenses, of standing armies and of other governmental expenditures necessitated heavier taxation, which led to the encouragement of manufactures and trade by the central governments; heavier taxation on the other hand was made possible by the greater security and increased production of wealth in the towns.

At the same time a struggle was going on between the local units of government and the central power. As the old feudal economy began to be supplanted by a national economy it was felt that the state must be made strong. It was a period of struggle between nascent states, and Mercantilism, which is defined by Schmoller as state-making, aimed to make the nation strong. In international relations, says this author, those states gained the supremacy "which understood how to put the might of their fleets and admiralties, the apparatus of customs laws and navigation laws, with rapidity, boldness and clear purpose at the service of the economic interests of the nation and state." The Mercantilists, therefore, emphasized the encouragement of foreign commerce and domestic manufactures, of agriculture and fishing. Seeing that those nations were strong which possessed large amounts of the precious metals, they laid great stress upon the importance of amassing and retaining within the national boundaries a store of money. Indeed wealth and money were often confused by the typical Mercantilist, though it can no longer be held that they identified them. This was the fundamental Mercantilist doctrine, and as a means of securing bullion, foreign trade was encouraged and regulated so as to secure a favorable balance. As a merchant marine was necessary to carry on trade, all measures that would develop a navy were approved, from navigation laws granting a monopoly of the carrying trade to home shipping to laws requiring the eating of fish so as to encourage fishing and thereby the training of sailors.

But since a nation must have commodities to trade with manufactures were also encouraged within the country, while agriculture was to be developed sufficiently to make the nation self-sufficient. A dense population was desired as an element of military strength. It was an all-around system of protection, regulation, price fixation and state control, which should not be thoughtlessly condemned, as it was admirably suited to the spirit and needs of the times. Charles V is said to have introduced it, but its best-known exponents were Cromwell in England, Colbert, the Minister of Louis XIV, in France, and Frederick the Great in Prussia. Among the best-known English Mercantilist writers were Mun, Child, Davenport, and Temple.

The Physiocrats.— Toward the end of the 17th century, and more markedly in the 18th, protests began to be urged against the extreme and burdensome restrictions of the Mercantilist policies. This system had performed its work and was outliving its usefulness. The agricultural revolution, already being consummated in England, was demonstrating the profitableness of agriculture when conducted scientifically with sufficient capital and rotation of crops. The growing manufacturers of the towns, too, felt themselves burdened and restricted by obsolete regulations and the monopoly of the guilds. It was in France particularly, where the burdens of taxation upon both agriculture and manufactures were especially onerous, that the protests found expression in a new system of thought. This was Physiocracy, which might be defined negatively as a revolt against Mercantilism, though it was much more than this.

At the basis of the Physiocrats' doctrines lay their nature philosophy, as indicated in the name they gave themselves (*φύσις κράτος* = rule of nature). By this they meant that social activities were subject to natural laws in the same way that nature is subject to physical laws. National well-being could be secured only by obeying these natural laws. The political application of this philosophy led to the social contract theory, according to which government exists for the benefit of the members of society and rests upon their consent. In the economic sphere this reasoning led them to approve of individual freedom and initiative. The functions of government should be limited to the protection of life, liberty and property, and the individual should be permitted to pursue his own interests and make the most of his labor. There should be freedom of exchange and competition, and all monopolies or restrictive privileges should be abolished. This idea was embodied in their famous maxim, *laissez-faire et laissez-passer* (let things alone, let them take their own course). Thus far the Physiocratic doctrine was negative and aimed to break down the restrictions of Mercantilism. But it contained also positive contributions to economic theory.

The central doctrine of the Physiocrats was that of the *product net* or net surplus. Only agriculture and the other extractive industries, as mining and fishing, are productive, that is, yield a surplus over the cost of production, and thereby increase the wealth of a nation. Manufactures and commerce are non-productive, for they merely give a new form and location to the materials produced by the extractive industries; the higher value of the manufactured articles is offset by the costs of production, the labor, provisions and materials used up in the process, and therefore there is no net surplus added to existing wealth. Artisans, merchants and the professional classes were regarded by the Physiocrats as sterile or non-productive. This doctrine led, of course, to a demand for the encouragement of agriculture by the state and the abolition of all measures mistakenly designed to encourage manufactures or commerce. These should be left to develop naturally. In criticism of the doctrine of productivity it may be pointed out that to the Physiocrats production meant an addition of material goods to the wealth of society. According to them, nature worked in a peculiar way in co-operation with the farmer; he alone added to the stores of material wealth. But the manufacturer or trader, who added only a form or place utility, was denied the name productive. This is contrary to modern economic theory.

From their doctrine of the *product net* followed logically their theory of the *impost unique* or the single tax. Since land was the sole and ultimate source of wealth, all taxes should be levied directly upon it. If they were imposed upon other branches of industry, they would necessarily be shifted as there was no surplus out of which to pay them, and they would all ultimately rest on the land. A single tax on the net income from land was therefore the simplest way to secure the revenue of the state.

The historical mission of the Physiocrats was to break the fetters of Mercantilism and to free industry and trade from the restrictions which were preventing its normal development. It was therefore in large measure a system of reaction and negativism. In its insistence upon

the sole productivity of agriculture it went too far, and a broader system had later to be developed by Adam Smith which should give manufactures and commerce their rightful place. Their doctrine of freedom of industry has exerted a powerful influence upon subsequent theory and economic policy. They also made positive contributions to the theory of taxation. The best-known writers among the Physiocrats were Frenchmen, Quesnay, Turgot, DuPont de Nemours, Mirabeau and Gournay, though the Englishman Cantillon had anticipated some of their doctrines.

Adam Smith.— Adam Smith has been called the father of political economy, and his book 'The Wealth of Nations,' published in 1776, has undoubtedly had a greater influence and won for its author greater fame than any other book on this or allied subjects that has ever been printed. It was justly famous, for it marks an epoch in the development of economic thought and for the first time presented a distinct systematic and comprehensive treatise on economics. Smith was not wholly original, for he built upon the labors of his predecessors,— and under the Physiocrats the science had already made considerable progress,— but he avoided their errors and added much that was his own. He embodied in his work many of the ideas of the Physiocrats, though he avoided their extremes, and was also greatly influenced by contemporary English writers, notably Hume. The great merit of his work lies in its eminent saneness, breadth of view and catholicity.

In his treatment of economics Smith introduced a new viewpoint. Hitherto all writers had considered the production of wealth as the end and aim of economic endeavor. But, though he dealt largely with production, Smith emphasized the importance of consumption: "Consumption is the sole end and purpose of all production and the interest of the producer ought to be attended to, only so far as it may be necessary for promoting that of the consumer." This is the modern standpoint. It was, however, often lost sight of by his immediate followers. Starting with the idea that the labor of a nation is the source of its annual income, 'The Wealth of Nations' opens with a classical discussion of the division of labor. Upon this division of labor depends in great measure its productiveness, but when this is introduced each member of society depends upon others for the satisfaction of most of his needs; hence arises the necessity for exchange and the use of money. The exchange of goods necessitates their comparison and hence the idea of value arises. From this point Smith is led to study the component elements of price, wages, profits and rent. These researches fill the first two books and constitute his general economic scheme. The third book is historical in character and contains an account of the economic development of Europe; while the fourth book is devoted largely to a polemic against Mercantilism and Physiocracy; the fifth deals with public finance.

Smith's work, like that of the Physiocrats, was largely destructive; he had to overthrow before he could build up. He advocated the "simple and obvious system of natural liberty" and paved the way for free trade in England. He taught that when each individual pursues his own self-interest the best economic interests for society will be secured. While he stood for freedom of trade and personal liberty and initiative of the individual, he admitted certain modifications in this doctrine, as in his approval of the navigation laws, of a protective tariff for retaliatory purposes and in certain other cases of government interference. There is little doubt that if he could have seen some of the evils which followed this doctrine of non-interference after the development of the factory system, he would have modified his views still more. Indeed one of the criticisms later urged against Smith is his theoretical absolutism. He is also criticized on the ground that he was unduly individualistic and materialistic, but in these respects he reflected the general philosophy of his age. He showed his breadth of view and judgment by taking what was best in the prevailing theories of his predecessors and combining this into a unified system, to which he also made original contributions, notably in his discussion of value.

One reason for the success and popularity of Smith's work was that he wrote just at the beginning of a great industrial revolution. Before this time the system of industry in England was the so-called domestic system, under which the work of production was carried on in the home of the worker by hand methods, though middlemen operating on a considerable scale had already appeared. But beginning about 1760 there occurred a remarkable series of inventions which affected many lines of industry — cotton spinning and weaving, coal mining, iron smelting, manufacture of earthenware, and the improvement of transportation by the construction of roads and canals. The epoch-making change of this period lay, however, not in this series of inventions, important as they were, but rather in the substitution of non-human power for human muscles. This was first made possible on a commercial scale by Watt's improvement of the steam engine. A vast expansion of industry now took place, the factory system supplanted the domestic system, capital found new applications and began to play a more important rôle, while new labor problems arose with the new conditions of industry. New industrial forces were liberated which demanded freedom from old restrictions and the new industrial leaders approved highly of Smith's doctrine of non-interference. This accordingly became the corner stone of English economics for the next generation or so, until the evils of this policy became so apparent as to lead to reaction. We may note some of the followers of Adam Smith.

Malthus.— By 1798 many of the evil effects of the Industrial Revolution were showing themselves and unemployment, poverty and disease were already problems that called for remedial treatment. Thomas Robert Malthus (1766–1834) had his attention directed to these evils while discussing a socialistic scheme of William Godwin and wrote his "Essay on the Principle of Population" to refute such utopian cures. In this he held that population tends to increase faster than the means of subsistence; that this tendency is restrained only by certain "positive" checks in the form of famine, disease and war, or by a "preventive"

check in the shape of moral restraint, such as the postponement of marriage. Any socialistic society, he therefore held, in which there was universal well-being and in which these checks did not operate, would be speedily broken down by his single principle of population. Malthus' essay has given rise to an enormous amount of discussion and has had an important practical influence in the attitude of economists and others to various schemes of social reform. His principle of population must be held to have stated an important truth, though it was not original with Malthus and was greatly exaggerated by this writer and his followers.

Ricardo.— David Ricardo (1772–1823), another follower of Smith, is best known for his theory of rent. While this was not original with him it was so fully developed in his 'Principles of Political Economy and Taxation' that it has generally been known since as the Ricardian law of rent. Briefly stated the theory is that rent is due to the difference in cost of production on any given piece of land and the poorest land under cultivation. Rent is therefore a differential return which is due to the necessity of resorting constantly to poorer lands. It is a result of high prices and of the niggardliness of nature, which yields smaller and smaller returns to successive applications of labor and capital to the cultivation of the soil. This idea of a resort to inferior soils and of diminishing returns in agriculture, combined with Malthus' principle of population, gave rise to a most pessimistic theory of wages, known as the "iron law of wages." As stated by Ricardo, "the natural price of labour is the price which is necessary to enable the labourers, one with another, to subsist and to perpetuate their race, without either increase or diminution" (Ch. V, § 1). If wages rise temporarily population will tend to increase and this will cause a fall again in the rate of wages. Nor will it help the laboring class to exercise thrift or self-restraint, for then wages will fall to the new level necessary for their subsistence. The remedies proposed by Ricardo himself were the abolition of the poor laws and the development among the laboring classes of a higher standard of living. Ricardo made important contributions to the theory of money, to which subject his rigidly deductive method and his analytical skill were well adapted. In this respect his influence was unfavorable, for economic method was for many years diverted from the combination of inductive and deductive reasoning employed by Adam Smith to a purely deductive one. A false impression of accuracy and finality was thus given to economic theory.

Perhaps no writer went further than did Nassau William Senior (1790–1864) in narrowing the scope of political economy and treating it as an abstract science. His name is usually associated with the abstinence theory of interest, which was his contribution to economic thought. Ricardo had stated that the value of goods was fixed by their labor cost, but Senior pointed out that cost of production includes the "abstinence" of the capitalist in saving his capital for production, for which he must be rewarded. His new term was somewhat unfortunate because negative in meaning, but his emphasis of the contribution of capital to production constituted a real advance in theory. Most of the other English writers between Ricardo and John Stuart Mill were of minor importance and may be dismissed with a mention of their names. The principal ones were R. Jones, James Mill, J. R. M'Culloch, Robert Torrens and W. T. Thornton.

The Classical School in France.— The influence of Adam Smith and of the so-called English classical school of political economy was, however, not confined to England, but affected France and Germany. The writer who most undeviatingly followed Smith was the French writer, J. B. Say (1767–1832). In his 'Traité d'Economie Politique,' published in 1803, he popularized 'The Wealth of Nations,' but in so doing he reorganized and simplified the subject matter. His work was more than that of a mere popularizer, however, and he made some original contributions of his own. In his hands economics became a purely theoretical and descriptive science, being divorced from the practical politics of the Mercantilists and Physiocrats. Writing a generation later than Smith he witnessed the introduction and spread of the factory system and consequently emphasized manufactures and machinery more. He is probably best known for his theory of markets in which he argued that money is only an intermediary: "products are given in exchange for products." Hence he concluded that a general overproduction is impossible and that foreign trade is advantageous. He, therefore, advocated free trade.

A later French writer, who even more emphasized the doctrines of *laissez-faire* and individualism was Frédéric Bastiat (1801–50). His most ambitious work was his 'Harmonies Economiques,' in which he argues that there is an essential harmony of interests between labor and capital and between various economic interests. "It will always be historically interesting," says Ingram, "as the last incarnation of thorough-going economic optimism." Already however the logic of events had brought about a reaction against such extreme individualism and this book made little impression. More important for their practical effects were his shorter pamphlets against protection and socialism, which were characterized by a lively and vigorous style.

Other French writers of this period were Augustin Cournot (1801–77), who was one of the first to apply mathematics to the treatment of economic questions, and Charles Dunoyer (1786–1862). In general the French school simply reaffirmed and developed the principles of economic individualism laid down by the English classical school, but were characterized by an optimism which contrasts strongly with the pessimism of Malthus and Ricardo.

The Classical School in Germany.—German expositors of Adam Smith displayed more independence and originality than did the French writers. Of these may be mentioned K. H. Rau (1792–1870), F. B. W. Hermann (1795–1868), F. Nebenius (1784–1857) and J. H. von Thünen (1783–1850). Rau exercised considerable influence through his encyclopædic 'Lehrbuch der Politischen Oekonomie,' which combined Adam Smith's political economy with much historical, statistical and technical infor-

nation. His contribution to economic theory consists in his separate analysis of the entrepreneur's gains or "wages of management." Nebenius wrote on public credit and Hermann on a number of special subjects, which he treated with great ability. But von Thünen made the most important contributions. In his work 'Der Isolirte Staat' he studied the effect upon rent of situation with respect to the market; he thus supplemented the Ricardian theory which had emphasized differences in fertility. He also made a study of wages and drew up a formula to express natural wages, which he thought should be proportional to the amount of the product.

Critics of the Classical School.— The work of Smith, Malthus and Ricardo had a certain air of finality and it seemed to their immediate followers that the science of political economy was complete. But even before their task was accomplished the new system of thought was subjected to criticism and attack. The critics or opponents belong to various groups according as they attacked one feature or another of the classical school. There were first those who opposed the extreme doctrine of individualism and unrestricted competition for which Smith stood; second, those who were antagonized by the broad cosmopolitanism of the classical school and who advocated a national program; and third, those who disapproved of the unethical features in the principle of self-interest and the institution of private property.

(1) Critics of Individualism.— In the first group fall Lord Lauderdale (1759–1830), John Rae (1786–1873) and J. C. L. Simon de Sismondi (1773–1842). The first two of these writers pointed out that there is no necessary identity between the interests of the individual and those of society as a whole, and approved of government interference in many cases. According to them a distinction must be made between public wealth and private riches; the increase of the latter does not necessarily mean that the nation is better off. Sismondi called himself a disciple of Adam Smith, but he disagreed with the method, the aim and the practical conclusions of the classical school. He insisted that the method should be more historical and the aim more ethical. Finally he rebelled against the undue emphasis upon the mere production of wealth and the neglect of human suffering involved in the introduction of new processes and machinery. He agrees with the two former writers in insisting that there is no necessary identity between private and social interests. In his theories of overproduction and crises indeed he almost approaches socialism.

(2) Critics of Free Trade.— Of all the doctrines of the classical school the one which was most widely accepted was the theory of free trade. In every country this idea had been accepted by economists. And yet it was not long before opponents of this doctrine sprang up, no one of whom, however, was English. The first to give expression to this nationalistic reaction was Adam Müller (1779–1829), a German, who advocated the policy of protection to home industry on the ground that it promoted national feeling. For the same reason he even approved of government paper money and of war. He attacked the atomistic individualism of Smith and insisted upon social welfare.

Much more important was Friedrich List (1789–1846), who was born and died in Germany, but who spent a number of years in the United States where he accumulated a fortune. The title of his principal work, 'Das Nationale System der Politischen Oekonomie,' gives the key to his position. It is really a treatise on international trade in which he attacks the free-trade principles of the classical school. His chief contribution was his theory of the stages of economic development. Every nation, he says, passes through the stages of pastoral life, agriculture, commerce and manufacturing, but not all nations are in the same stage of development at a given time. Hence the government should assist a people who wish to pass from a lower to a higher stage against the competition of those nations which had already attained their full industrial growth. Practically he advocated protection for undeveloped Germany against industrial England. His doctrines had great influence upon German thought.

Henry C. Carey (1793–1879), an American writer, was also a protectionist and a nationalist, and on both these grounds criticized the teachings of the classical school. The best exposition of his views is to be found in his 'Principles of Social Science.' His main arguments in favor of protection are, first, that manufactures would develop association and diversity of interests, by which civilization would be better promoted than by agriculture alone. His second argument was more original, and is based on the necessity of returning to the soil what is taken from it. If a country exports foodstuffs and raw materials in exchange for manufactured goods, it depletes the soil and the land soon becomes exhausted; the ideal is a community where manufactures and agriculture are carried on side by side. He also attacked the Ricardian theory of rent and the Malthusian doctrine of population. Carey exercised considerable influence in the United States by his writings.

(3) Socialist Critics.— The third group of critics of the classical school was the early socialists. Most of these were French. Orthodox economists had always treated private property as an inevitable and necessary institution. Now, however, we meet a group of writers who attack the ideas of private property and of competition. The Industrial Revolution had wrought sweeping changes in society since the time of Adam Smith and had been followed by many economic maladjustments and evils, such as child labor, low wages and crises. In seeking an explanation of these phenomena the socialists were led to attack the existing system of industrial organization and the economic school which defended it. The most important of these writers were C. H. Saint Simon (1760–1825), Robert Owen (1771–1858), Charles Fourier (1772–1837), Louis Blanc (1813–82) and P. J. Proudhon (1809–65). The first three of these wished to organize the labor force of the country for productive purposes into small associative or co-operative groups by voluntary action. Blanc proposed that the government should assist the establishment of such associations by advancing capital. Proudhon would have abolished government. They all attacked the existing institutions of competition, which Blanc insisted was the cause of every economic evil, and of private property which Proudhon said was theft. While often utopian and vision-

ary they were important as critics of existing economic theory by their attacks on institutions which had been accepted as matters of fact, while their insistence on the social nature of production was a valuable corrective to the individualistic tendencies of the classical school.

Mill's Restatement.— Modern economic science had first been formulated by Adam Smith; since his time Ricardo had added his theory of rent, Malthus his theory of population and Senior that of abstinence. On the other hand various writers had attacked certain phases of his teachings or had modified certain conclusions. And more than all the Industrial Revolution had completely changed the economic world which Smith described and had brought new problems to the front. The time was now ripe for a restatement of the principles of economics which should take account of all these changes. In John Stuart Mill (1806–73) such an expositor was found. His book, 'Principles of Political Economy, with some of their Applications to Social Philosophy,' published in 1848, combined and organized all that was enduring in his predecessors' work. It is extremely logical and well written, but contains little that is original. As the clearest statement of English classical economics we may note its main teachings.

Self-interest was accepted as the motive to economic activity. Since each individual is the best judge of his own interests individual liberty is essential to economic progress; state interference was therefore disapproved of save in exceptional instances. Value is determined in general by demand and supply. Mill distinguished between normal and market value; at any given time demand and supply determine market value, but in the case of freely reproducible goods their normal value is set by the cost of production. His theory of value is therefore a cost theory. The Ricardian theory of rent and the Malthusian doctrine of population were fully accepted, and Mill often declared that there was no hope of improvement in the lot of the working class unless they checked the growth of population. His theory of wages is essentially that of the wages-fund, which may be stated as follows: there is a determinate number of laborers who must work and a determinable amount of capital unconditionally destined to the payment of wages (i.e., the wages fund); this fund is distributed among the laborers solely by means of competition, and the rate of wages depends on the proportion between capital and population. Only by encouraging the growth of capital by means of saving, or by discouraging the growth of population, can the equation be favorably modified and wages raised. Mill made a real contribution to economics by his development of the Ricardian theory of trade — it is not the difference in absolute costs of production as between two countries, but in comparative costs, that determines international trade; foreign trade is therefore an advantage to all countries, but especially to backward ones. He did not give any space in his book to the subject of consumption, which finds a large place in modern works, but he showed himself very sympathetic with the demands and aspirations of the working classes. Indeed in his later years he recanted the wages-fund theory and took a long step toward socialism.

With Mill's 'Principles' the teachings of the classical school reached their climax and from now on we meet with increasing dissent from and modifications of its ideas. Exceptions may be made in the case of J. E. Cairnes (1824–75), whose chief contribution lay in his theory of non-competing industrial groups, which limited the scope of competition to a much smaller area than that usually assigned it; of Michel Chevalier (1816–79) of France, and of the Swiss A. E. Cherbuliez (1797–1869). The reaction showed itself most prominently in Germany where the teachings of the classical school had never been accepted as fully as they had been in England and in France. To Germany, therefore, we must look for the next forward movement in economics. This was contributed by the historical school.

The Historical School.— Three names are usually associated with the rise of the historical school in Germany, those of Wilhelm Roscher (1817–94), Bruno Hildebrand (1812–78) and Karl Knies (1821–98). They expressed their disagreement first of all with the abstract deductive method of the older school and insisted that the proper method was inductive and historical. Later writers of this school, as Gustav Schmoller and Karl Bücher, have laid less stress upon this point, and modern scholars no longer concern themselves with this barren controversy. As Schmoller says, "Induction and deduction are both necessary for the science, just as the right and left foot are needed for walking." Another point of disagreement was their denial of the existence of economic laws. Influenced by Hegelian philosophy and later by the theory of evolution they emphasized the relativity of such generalizations, and pointed out that so-called economic laws are provisional and conditional. On this point there would be little disagreement to-day; the only question would be as to what name to apply to such economic tendencies. The historical school also criticized the hedonistic psychology of the earlier writers and asserted that man is influenced even in economic activities by other considerations than those of self-interest. Perhaps it is putting the case too strongly to say, as M. Rist does, "this newer historical conception came to the rescue just when the science was about to give up the ghost, . . . infusing new life into the study," but they certainly offered a valuable corrective to the abstract tendencies of the classical school and have led to a great interest in economic history.

The Psychological School.— Another school which has played a very important part in the development of recent theory is the Austrian or psychological school. They emphasize the importance of subjective factors and analyze value on the basis of utility. While the first economists to emphasize these features were a German, H. H. Gossen (1810–58), and an Englishman, W. S. Jevons (1835–82), it remained for an Austrian group to apply their subjective theory of valuation to all the factors of production, and to develop consistent theories of interest, wages and profits. The foremost members of this school are Carl Menger, F. von Wieser and E. von Böhm-Bawerk (1851–1914). Their main contribution has been their analysis of value, which they have clarified by the concept of marginal utility. Value rests on utility and relative scarcity, or to put

it in the words of Wieser, "the value of a single good out of a store is determined by that useful service which is the least important among those afforded by the store." Mill's cost of production theory of value is rejected, or at most cost has only an indirect influence; value rests on subjective utility. The Austrian school also extend their theory of value to the means of production and even to problems of distribution. The application of the utility theory to the problem of interest was made by Böhm-Bawerk, but it has remained for American economists to apply it to problems of money, wages and profits. Among these may be mentioned J. B. Clark, I. Fisher, S. Patten, T. N. Carver and F. A. Fetter. This school has contributed to the advance of economic science by emphasizing the subjective elements in contrast with the classical school, but in sympathy with them and in contrast with the historical school they have reverted to the use of the deductive method. Out of the discussion between these various groups however it has become clear that, just as both inductive and deductive methods are needed, so both objective and subjective factors must be considered in the problems of economics.

Modern Socialism.— As critics and antagonists to all these schools stand the socialists, who since the day of Karl Rodbertus (1805–75) have become more scientific and less utopian. Rodbertus propounded a notable theory of crises, which he thought were due to insufficient purchasing power on the part of the laboring classes; poverty and crises can be avoided only by the socialization of property. More important was Karl Marx (1818–83) whose book 'Das Kapital' became the veritable bible of the socialists. He held a labor theory of value, which led him to conclude that profits and interest and rent are robbery, and that socialism is both inevitable and necessary. Socialistic criticism has been valuable in overthrowing the conception of a natural order, in developing the social viewpoint, and in leading to greater emphasis upon distributive justice, which, while never overlooked even by the classical school, had not received the attention it merited.

Economic Thought in the United States.— Recent years have seen in the United States a development of economic thought not surpassed in any country. With the exception of H. C. Carey, American economists had usually followed the teachings of the classical school, until the brilliant writings of F. A. Walker (1840–97), who attacked the wage fund theory and developed the idea of enterpriser's profits. The formation of the American Economic Association in 1885 was a sign of the growing interest, and this has been followed by the establishment of half a dozen journals devoted to economic affairs. As might be expected in a new country, which was rapidly developing and whose natural resources were being exploited, there was considerable revolt against the pessimism and abstraction of the classical school. Many of the members of the rising group of writers had received their economic training in Germany and were in sympathy with the historical school. And finally the theories of the Austrian school have been accepted and carried forward by still another group. So that the development of economic thought in the United States parallels that which has taken place elsewhere, but has been characterized by much that is original and noteworthy. Among those who may be mentioned as having established a claim to recognition are H. C. Adams, T. N. Carver, J. B. Clark, J. R. Commons, R. T. Ely, H. J. Davenport, D. R. Dewey, F. A. Fetter, I. Fisher, A. T. Hadley, E. J. James, D. Kinley, J. L. Laughlin, S. Patten, E. R. A. Seligman, F. W. Taussig and T. Veblen.

Conclusion.— It is difficult to draw any conclusions from an account of the development of the science of economics, for the one outstanding fact in this study is that it has been full of change and that the end is not yet. Out of the conflict of ideas however there has developed a body of knowledge which affords a common ground for all and constitutes the science of economics of to-day. The subject matter of this science, so far as it is a pure science, has moreover narrowed, having sloughed off such subjects as political science and sociology, now treated independently. In one respect it seems to have completed the circle: starting with theological conceptions it gradually eliminated all motives but the purely economic; but recently, under the influence of the socialists and of a greater humanitarianism, ethical considerations are being given more emphasis, at least in the practical application of economic principles.

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ECONOMICS AND THE WAR. When in the early autumn of the year 1914 the present great war was forced upon the world by the joint action of Germany and Austria-Hungary, the great powers had been at peace with each other for a period of nearly 50 years and during this interregnum of the war lords, economic conditions, including especially domestic production, monetary and banking systems, international trade and the various other institutions of an organized economic life had become stabilized by the relatively unchanging demands of a world at peace. The mobilization for war radically changed, almost in the twinkling of an eye, the conditions under which the economic life was thenceforth to be

carried on, and as a necessary consequence the economic life itself. Economic customs and institutions hoary with age and venerated and perpetuated because they had been useful under other conditions were continued without question, then questioned, then abandoned as the requirements of war were found to differ from those of peace. While war is destructive of human life and the savings of the past, it is also and in no less measure the destroyer of outgrown institutions and customs and the creator of new ones, some of which may prove permanently beneficial, while others may be discarded as mistaken attempts to meet the changed conditions. When the German War Council met at Potsdam on 5 July 1914, it was attended by the great bankers, railway directors and the captains of industry as well as by the war lords and the representatives of the state. The representatives of every line of activity, finance, transportation, trade and industry as well as the army and navy were solemnly asked by the Kaiser if they were ready for war, and all except the financiers replied in the affirmative.* The financiers were not ready, they must have two weeks to make the final preparations for the great war. The reason given by Wangenheim in his account of this historic conference was that the bankers must have time to sell foreign securities and to make such loans as might be necessary to prepare their banking institutions and their other financial interests for the initial shock of the war. The request of the financiers was granted and the Serbian ultimatum postponed for the period named to give the banking institutions time to arrange their loans and to convert their foreign securities into gold or credits as nearly liquid as they might find feasible. This financial moratorium while not so important as many events which have taken place during the war clearly illustrates an important principle. War separates or tends to separate the nations engaged in the conflict from each other, severing the economic ties which bind them, and forcing them to adopt either one or both of the following plans: first, they may seek to establish economic relations with countries other than those with which they have been trading, or second, they may attempt to provide for all their own wants by diversifying their own industries until as nations they have become entirely self-sufficient. During the present war both of these expedients were adopted. For the past half century, Germany has, by the conscious effort of her government, adopted the policy of using economic pressure to force her citizens to provide more and more fully and completely for their own wants. During a much longer period, England has specialized as a producer of a limited number of commodities and has relied upon her ability as an international trader to exchange a part of her products for such other commodities as she needed for a fully developed economic life. When war was declared, Germany ordered her navy and merchant ships to seek safety in the most convenient ports and thereafter she and her allies have relied upon their own diversified production together with such neutral trade as has been able to gain access to her markets to provide for the wants formerly supplied by imports from all parts of the globe. England, France and the United States on the other hand adopted, partly by necessity, partly by choice, the policy of keeping the seas open to their merchantmen and developing their international trade as never before. While Germany has doubtless been building both battleships and merchantmen as a preparation for the trade competition that will inevitably follow the conclusion of the war, the allied nations have been forced to do the same as a necessary condition of carrying on the war at all. This in itself has caused a profound change in the economic life of the United States and has intensified the most marked economic characteristic of English industry and trade. The change referred to has already begun to have its immediate effects and its after-effects will be even more significant. To carry on international trade, ships are necessary and if a nation is to be at all independent, it must provide its own. At the beginning of the war, the United States possessed a fairly strong navy and a considerable fleet of ships suitable for coastwise traffic. During the first two years and a half of the war, the United States was called upon to supply the warring nations with food, raw materials and such manufactured products as she was able to supply in ever-increasing quantities. It is of course stating a self-evident fact to say that the United States could not grow wheat and build ships with the same identical labor and capital; that as she built more ships she must grow less wheat and mine less iron and coal and that consequently her creative power was diverted by the demands of war from the production of food and materials to the building and sailing of ships.

That the after-effects of the increase in tonnage and the new avenues of international trade thus opened up by the war will prove to be permanent factors in our economic life is hardly open to doubt. Our ships, built to help win the war, will after peace has come be active agents in promoting the interchange of goods between the United States and every other nation, which by reason of its geographical situation, soil and climate, or the peculiar training of its people, is able to produce for us goods that we cannot so well produce for ourselves. International trade promoted by the war will not cease with its termination. To sell to others we must in turn buy of them and consequently the stimulation of international trade by the war will after peace has been declared tend to promote freer trade relations with the rest of the world than has prevailed in the past.

The first effect of the war was to check international trade, but not for long. Soon the demands of the nations at war for war material began to be felt and with this demand international trade began to revive but at the same time its character changed both in quantity, in direction of flow and in kind. In the case of the United States the war checked exports to such an extent that for August 1914, the balance of trade was against us by over $19,000,000. Late in September foreign buyers began to appear and gradually exports began to flow out in ever-increasing quantities until limitations imposed by lack of shipping served

* Morgenthau, the *World's Work*, June 1918.

to cause a temporary check. In September 1914, the balance of trade was again in our favor and for the last five months of the first year of the war the total excess of exports from the United States over imports was $264,000,000. Despite the submarine warfare, the lack of shipping and the high rates for freight and insurance, both exports and imports continued to increase year by year and generally month by month until at the present time the total of our foreign trade is approaching $10,000,000,000 per year with an excess of exports of over $3,250,000,000. The following table shows the important facts in regard to the quantity of our international trade since the outbreak of the war:

INTERNATIONAL TRADE OF THE UNITED STATES
(In millions of dollars)

	1914 Aug.-Dec.	1915	1916	1917
Exports	913	3,559	5,481	6,226
Imports	649	1,779	2,392	2,952
Excess of exports	264	1,776	3,089	3,274

If now we compare our exports and imports during the war with those of the period of equal length immediately preceding the outbreak of hostilities, it is possible to show how much and in what ways our external trade has been affected.

INTERNATIONAL TRADE OF THE UNITED STATES
(In millions of dollars)

	1 July 1910 to 30 June 1914	1 Aug. 1914 to 31 July 1918	Change per cent
Exports			
Raw materials	2,961	2,733	*8
Food stuffs	1,738	4,852	179
Manufactures	4,212	11,526	174
Miscellaneous	173	563	225
Total	9,084	19,674	116
Imports			
Raw materials	2,336	3,913	67
Food stuffs	1,661	2,521	52
Manufactured goods	2,829	3,058	8
Miscellaneous	61	1,066	1647
Total	6,887	9,558	38
Balance	2,197	10,016	355

*Decrease; all others increases.

From these tables it may be noted that while our imports increased in each of the four great classes into which the commodities are here grouped, the marked increases are confined to raw materials and food. With regard to the exports the effect of the war has been to lessen the export of raw materials and to increase measurably both foodstuffs and manufactured goods. Comparing the two periods with respect to the quantity of international trade, it may be noted that while the total of both exports and imports more than doubled, the balance of trade for the four years of the war was almost five times that of the preceding four years. The change in the character of the trade necessarily affected our industries by throwing new burdens upon those where the balance of trade in our favor increased most rapidly. How well our agricultural classes and our manufacturers have met the call upon them is evidenced by the partial failure of the railroads and the shipping facilities to move the goods to the ports and across the Atlantic as fast as they are made ready for the transportation agencies.

The increasing balance of trade in our favor, proving our power to assist in feeding, clothing and arming the nations at war while at the same time providing for our own needs, has raised questions in international finance that before the war had been thought to be of little practical importance. Writers on international trade have generally taught that exports from any country are limited by its ability to purchase goods in exchange, for the reason that otherwise the country exporting becomes short of goods and overstocked with money, thus making goods dear and money cheap. The exporting country then becomes an importer, exchanging its surplus money for the goods which it needs and the balance of trade then turns against it. Before the war the United States was using the credit due it from the excess of its exports in various ways. In the first place, it was hiring its goods freighted across the water in the ships of other nations and it was also to a large extent purchasing insurance of the English and German companies. In the second place, it was paying interest on approximately $6,000,000,000 of European capital that had been invested in American railways and other industries. In the third place remittances to friends and travel in European countries accounted for another portion of considerable size; and in the fourth place, it imported regularly a small amount of gold, the last resort in settling foreign trade balances. When the balance in our favor continued to grow despite the use of the ordinary methods of settlement it become evident to the American financiers as well as to those representing the various European countries with which we were trading that other means of adjusting our growing credit must be employed. The first means actually used was the repurchase of American securities. At first it was feared that securities held abroad would be dumped in quantities upon the market at a time when conditions for their purchase were so unfavorable that the prices would break far below intrinsic levels and to guard against such a catastrophe the stock exchanges in all the leading commercial countries were closed for a time. It was, however, found that the European holders were loth to part with their American securities and when after borrowing and purchasing a considerable quantity for the purpose of securing a loan the English government thought it desirable to support sterling exchange by the further sale of securities it was found necessary to impose a special tax of 10 per cent upon the income of all foreign securities held in England in order to encourage their holders to part with them and thus help settle the debts arising from the excess of imports. Mr. Loree's investigations showed that of the $5,000,000,000 to $6,000,000,000 of American securities held abroad at the beginning of the war only about $1,000,000,000 were repurchased before 30 June 1915, and not over $1,250,000,000 were sold here during the period 1 Aug. 1914 to 31 Jan. 1917. The difference between the value of the exports and the value of the imports, plus freights, insurances, remittances to Europeans, travel in foreign countries, the value of purchased securities, and

the importation of gold, notably in the latter part of the year 1916, has been paid for out of the proceeds of loans placed in this country directly or through the medium of the United States government.

Within a country at war, the changes in its economic life are pronounced and permanent. From the economic standpoint, the human life that is sacrificed by war either permanently or for the period of the conflict reduces the productive power of the nation by the amount thus sacrificed. With regard to capital the same principle holds true. Land, labor power and capital united into working units are the producing agencies in every stage of economic activity. War has a double effect upon all these. It destroys and it diverts. It uses land for war purposes, thus preventing its use for productive ones. Land devoted to camps, cantonments and aviation fields cannot at the same time grow corn and wheat; land over which a battle has raged for some length of time is thereby rendered temporarily unfit for agricultural purposes, as witness northern France and parts of Belgium. War first diverts a considerable portion of the labor power from the work of creation to that of destruction, and during the process the labor power thus diverted is actively engaged in destroying the labor power of the enemy and the capital of both. With capital the same general conditions prevail. A considerable portion of our capital is and for the past four years has been exclusively employed by and devoted to the claims of war. An excellent illustration is furnished by the cotton situation. The 1914 crop was an unusually heavy one and the sudden interruption of industry caused by the war lessened the normal demands of the trade so much that a cotton pool was formed for the purpose of loaning $135,000,000 to those wishing to hold their cotton and thus prevent the ruinously low prices that would be likely to result. As soon as the war was well under way the demands for cotton for war purposes become sufficiently urgent to counteract the lessened demand from the ordinary trade so that the pool was dissolved after having loaned only $28,000.* Since 1915 the price of cotton, owing to its use for explosives as well as for clothing, has risen to new high levels and the problem has become one of furnishing cotton rather than of providing an artificial market to prevent prices falling below the cost of production.

When land, labor and capital are working together in proper proportions and the units thus formed are wisely directed, not only is production at a maximum, but, what is almost if not quite of equal importance, the three factors of production share the results of their joint efforts in fairly equitable proportions. War as a destroyer does not always act impartially. Sometimes it destroys men faster than it destroys capital. Sometimes the reverse is true. In almost every case, land as a factor of production suffers less than either of the other two factors. When men and consequently labor power is destroyed faster than capital, the labor element in production becomes deficient in quantity and hence in response to the urgent demand for more labor power, wages rise relatively to the rate of interest; conversely, when capital is destroyed or diverted from productive uses faster than labor power embodied in man, then the interest rate rises faster than the rate of wages. Attention should be called to the fact that it is always the net available supply of labor and capital that is referred to. If the productive power of the laborers is augmented by an increase of speed, if machines are operated more continuously, each of these methods of increasing efficiency will counteract the absolute loss of men and machines. During the present war, the diversion and destruction of men and capital has caused both wages and interest to rise, while rents in relation to wages and interest, except in areas crowded as a result of peculiar conditions, have fallen. Whether wages have risen more rapidly than interest or the reverse has not yet been demonstrated owing to the inherent difficulties of determining the rate of wages.

A. The direct effect of the unprecedented destruction of capital is reflected in the rate of interest. A somewhat less direct but none the less important effect may be observed in the speeding up of industrial establishments and the increased efficiency with which capital is used. A third effect is found in the various expedients adopted to prevent the investment of new capital in any industries except those which are essential to the successful prosecution of the war.

(1) Immediately after the outbreak of the war interest rates were not only high but were also unduly fluctuating and as a result various means of stabilizing the rate and preventing its rise to abnormal heights were discussed and some attempts to control the rate were in a measure successful. In general, however, the fears of financiers and the large borrowers were never realized, for while the rate of interest has advanced as a result of the destruction of capital by the war, the advance has been much less than was early predicted. Take for example the discount rate of the Federal Reserve Board; 31 Dec. 1914, the New York rates were as follows: for 30-day paper, 4½ per cent, for 60- and 90-day paper, 5 per cent; on 24 May 1918, the rates were: for 16- to 90-day paper, 4¾ per cent. In the commercial paper market the advance has been somewhat marked especially during the past year. In August 1917, the rate for standard commercial paper was 5 per cent; one year later, it was 6 per cent. The bond market also shows a gradual increase in the interest rates. In December 1915, 40 standard bonds, selected for comparison by the *Wall Street Journal*, were selling at an average price of 94.03 per 100. In December 1916, the same bonds were selling at 94.97, a slight advance. In October 1917, they had fallen to 86.73 and on 29 April 1918 to 83.61. During the same period, the return on standard government bonds has advanced from an average of less than 4 per cent to an average of nearly 5 per cent.

(2) It is at this date quite impossible to make any quantitative estimate even of the increased productivity of industrial establishments resulting directly or indirectly from the threatened shortage due to the destructive effects of the war. It is, however, easily demonstrable that during the present great war, as during

* *Bulletin*, National City Bank, March 1915, p. 8.

those of preceding generations, our own industries as well as those of Germany, Austria, Italy, France and England have renewed their youth as it were and in many cases increased their productive power rapidly enough to more than neutralize the loss of capital resulting from the war. When the second great English war loan was floated, at that time called the greatest financial transaction in history, it was generally assumed in England and feared in this country that a flood of American securities held in England for investment would be thrown upon the market and that as a result our own security market would be thrown into confusion and values established by years of favorable earnings would be suddenly sacrificed. As a matter of fact the loan was floated at 4½ per cent and sold at par without seriously affecting the domestic or international market. So great was the productive power of the people of the United States that during the year 1916 they not only financed their own industries at a fairly reasonable rate of interest, but in addition purchased approximately $1,000,000,000 of foreign securities and repurchased a much larger amount of securities* of American corporations formerly held in European countries. And since the United States has been a participant in the war, she has financed her own loans and assisted her allies without at the same time disturbing either her savings bank deposits or her investment in foreign enterprises. Indeed so much had the net income of the United States increased during the war largely as a result of increased efficiency of capital and labor and their more harmonious co-operation that when the third Liberty Loan of $4,170,079,065 was taken in May 1918 by over 17,000,000 subscribers it was generally remarked that the money market was scarcely ruffled while the price of standard bonds was quoted as firm and advancing.† In addition to the repurchase of securities and the subscriptions to foreign and domestic loans, the American investment market absorbed during the year 1916, according to the tables compiled by the *Journal of Commerce*, over $3,500,000,000 par value of domestic capital issues.

(3) The increase of production and the maintenance of reasonably low interest rates has not been achieved without conscious effort on the part of both citizens and the government. Our citizens quite generally have eliminated unnecessary expenditures and confined their consumption to the essentials of an efficient life. They have thus been able to produce more while consuming less. Those who have been able to save something each month and each year have quite generally used better judgment in investing their earnings, although as yet there is, as always in the past, a strong tendency to take a chance on enterprises supported wholly or almost wholly by the glowing promises of their promoters. It is, however, chiefly by organized effort that the investment of new capital has been more wisely directed. Early in the war, bankers' associations, chambers of commerce, clearing-house associations and other organized groups of the smaller as well as the larger investors began to preach the doctrine that to win the war every dollar must be placed where it could do the most good. In this work the Investment Bankers' Association has performed a most valuable service. It first formed a capital issues committee* and then entered upon a campaign to secure the creation by the government of a commission whose function was to be to prevent the investment of new capital in non-essential lines. This movement to conserve capital by directing its investment into the more needed lines was inaugurated by the British government early in the war and through the efforts of the bankers and the Secretary of the Treasury† the Federal Reserve Board established in the latter part of the year 1917 a voluntary plan for passing upon capital issues of $500,000 or over in the case of corporations and $250,000 or over in the case of States, counties and municipalities. This Capital Issues Committee of the Federal Reserve Board was, however, not intended to be a permanent feature, for in the annual report of the Secretary of the Treasury for 1917 a plan for a war finance corporation was outlined, an institution which was intended to assist in the financing of essential industries as well as to restrict the flow of new capital into the non-essential ones. The plan of the Secretary of the Treasury met with some opposition but after its purposes were fully explained, it was passed by Congress early in April and on the fifth day of the month was approved by the President.‡ The War Finance Corporation Act created a corporation with $500,000,000 capital stock, all subscribed by the government, and empowered it to borrow on its own bonds not more than six times its paid-in capital. With the funds thus secured it was authorized to loan under conditions stated at length in the act to banking institutions and in certain exceptional cases directly to corporations. As a supplement to its financing power, the act authorized the President of the United States to appoint a Capital Issues Committee, three of whose members should be chosen from among the members of the Federal Reserve Board. This committee was authorized by the act to "investigate, pass upon and determine whether it is compatible with the national interest that there should be sold or offered for sale or for subscription any issue or any part of any issue of securities hereafter issued by any person, firm, corporation or association, the total aggregated par or face value of which issue and any other securities issued by the same person, firm, corporation or association since the passing of this act is in excess of $100,000.§ Since the creation of the War Finance Corporation with its auxiliary capital issues committee it may be affirmed that comparatively little of the new capital created by American industry has been squandered, and conversely that substantially all of it has been devoted to industries essential to the effective prosecution of the war.

B. As in the case of capital, war diverts labor from productive industries to the work of de-

* From 1 July 1915 to 30 June 1916 a conservative estimate was $1,500,000,000.

† *Bulletin* of the National City Bank, June 1918.

**I. B. A. of A. Bulletin*, vols. IV, V and VI.

† Hearings before the Committee on Finance, United States Senate, 65th Congress, 2d Session, on S. 3714, p. 9.

‡ Public. No. 121, 65th Congress, S. 3714.

§ Public. No. 121, 65th Congress, sec, 203, p. 9.

struction and after having accomplished its immediate purpose proceeds to kill, maim and invalidate a portion of those whom it has thus diverted. In this respect the effect of war on labor is entirely similar to that which it has on capital. There is, however, one marked difference that must not be overlooked, viz., the longer period generally required to replace the labor power which has thus been destroyed. A fleet of ships or a squadron of airplanes can be created from existing raw material within a period of from one to two years — but for a new army a nation must wait for its children to grow to men. As a necessary consequence of this well-known fact, the rate of wages is ordinarily more vitally affected by a war than the rate of interest and the present war is no exception. At the beginning of the war, industry was necessarily disorganized and during the period of readjustments that followed a large number of workingmen were laid off and unemployment threatened to become a serious menace to industrial peace. Just as gold pools and cotton pools were formed by the financial interests, so commissions on unemployment were formed in the larger cities to study the questions involved and to formulate plans for providing the unemployed with opportunities for earning a living. So early in the war as the winter of 1915 it was estimated that 2,000,000 wage-earners in the United States were without employment, although, as a result of the war, immigration from Europe had almost entirely ceased. This situation was, however, only temporary. By June 1915 the call for skilled mechanics exceeded the supply and common labor began to be short in the mines and the shops of Pennsylvania and West Virginia. By August, labor troubles began to loom up seriously, owing to the scarcity of labor, the consequent high wages offered to secure laborers by rival industries and rival plants, and the failure to advance wages of employees that had been continuously employed by individual establishments for a period of years. In England the labor situation became so menacing to national efficiency that in December 1915 a joint conference was called to consider the labor question and the demands of the wage-earners for increased pay. This conference was participated in by representatives of the government and of the labor unions and served to call attention to the underlying principles of the whole question of rising wages and the effects of such increases upon prices of products. Fortunately for England and the cause of the allied nations the labor situation was considered at this and other similar meetings in connection with its relationship to the national efficiency and the problems of war and as a result a system was gradually adopted of basing wages upon the general average of prices of commodities from month to month. Since the early part of 1916 the expansion of the industries in the United States has been limited more by labor shortage than by the lack of necessary capital. The shortage of labor was especially felt by the railways and seizing the favorable opportunity the railway trainmen began a campaign to secure an advance in wages as their fellows in the steel and textile mills had already done. In the spring of 1916, the shortage of labor extended to the farms and by May of that year it was generally considered that the labor shortage was the most important question in the industrial world. The advance in wages granted by the United States Steel Corporation for the 10-year period ending with the summer of 1916 is illustrative of the movement of wages in an expanding industry in response to a rising price level and an increasing shortage of labor due to the war. On 1 Jan. 1907 the United States Steel Corporation increased wages by 7 per cent; in 1910 by 6¼ per cent; in February 1913 by 10 per cent; on 1 February, on 1 May, and again 1 Nov. 1916, 10 per cent; on 1 May and again on 1 Oct. 1917, 10 per cent; while in March 1917 the steel companies generally advanced wages of common labor by 15 per cent. Advances in other lines were perhaps less frequent and in some cases less rapid, but in every line the advance was marked, especially so in the essential industries, such as the railways, textiles and the mining of coal. As already stated the railway trainmen began their campaign for an increase in wages early in 1916 and in April of that year a conference between their representatives and those of the railways was held for the purpose of considering the demands of the railway labor unions, which, stated in its simplest terms, was for an eight-hour day. The demands translated into actualities really amounted to an increase of wages owing to the obvious impossibility of rearranging the runs of the trainmen in such a way that each could be given a working day of eight hours. The result of granting the demands of the railway trainmens' unions must necessarily be to increase their pay by increasing the amount of overtime work, a result that was actually achieved in September 1916 by the passage of the Adamson bill and its subsequent approval by the Supreme Court of the United States. In the copper industry, one of those most affected by the war, the demand for labor has exceeded the normal supply and since April 1917 especial efforts have been made to prevent the shortage of labor from interfering with the supply of copper necessary for the successful prosecution of the war. For the first three years of the war a plan of basing wages upon the price of copper was followed with favorable results. During the past year, owing to German propaganda on the one hand and to the artificial control of the price of copper by the government on the other, the wage situation became alarming in certain districts in the West; strikes and their attendant incidents becoming the order of the day, with the result that a serious shortage of an essential article was feared. Fortunately here as in other industries the good sense and patriotism of our citizens, laborers and managers alike, re-established peaceful relations and the threatened disaster was averted. As for the other industries, such as the manufacture of brass goods not directly used in war, automobiles, hardware, etc., the demand for men in the war industries has been so abnormal that every employer of labor in the less essential occupations has been obliged to advance his scale, following often somewhat behind that established by the essential industries in order to hold his force at all.

The shortage of labor power caused by the

demands of the war has as its direct result checked production and advanced wages. The economic effects however do not end here. There are other results, less direct but none the less important, that have followed. The more important of these indirect effects are, first, the speeding up of labors' pace; second, the introduction of women into various vocations hitherto exclusively or almost exclusively occupied by men; and third, the forced diversion of labor from the less essential vocations to the more essential ones by the action of the various governments engaged in the war. Each of these movements is so important in the present and in the future that any adequate discussion of its causes and results would call for space beyond the limits permissible here and on this account those interested in such economic developments are referred to the books and pamphlets on the several subjects.*

It is, however, not in international trade, nor in the relationships of capital and labor to each other and to the other economic activities that the present war has had its most far-reaching effects. Of all the economic phenomena, prices of commodities are most easily affected by economic changes and on this account it is here that war accomplishes its most important economic results.

The Civil War, it will be recalled, was accompanied by a rapid increase in the price level and was followed for a period of 30 years by a continuous decline. Beginning about 1896, as a result of improvements in smelting and the opening up of new mining districts, the output of gold increased so rapidly that the downward trend was converted into an upward movement that still continues. By 1904 prices had ascended to a level substantially equal to that of 1860 and by 1914 the general level was approximately 50 per cent above the low point of 1896. Since the outbreak of the war prices have continued to rise at an unprecedented rate until at the present writing, September 1918, the general level is estimated by the United States Bureau of Labor Statistics to be somewhat over 90 per cent above that prevailing in 1914. The basic causes of the rise in prices both before and during the war are well understood. Prices are the rates at which goods exchange for money and consequently anything that makes goods relatively scarce and money relatively plentiful causes prices to rise. The primary economic effect of war it must not be forgotten is to cause commodities to be used up more rapidly than before and at the same time to lessen the productive power of the nations at war. Commodities then become less plentiful with respect to wants and prices begin to rise. Under normal conditions the rise in prices induces producers to work harder and as a consequence goods become more abundant and then prices fall. In times of war, and pre-eminently in a war making such unprecedented demands for arms, munitions, aircraft and other offensive and defensive instruments of warfare, a considerable portion of the productive forces are engaged in war activities and the remainder are incapable of fully answering the calls made upon them. Food and clothing then become relatively scarce and despite the efforts of those producing the commodities needed for a comfortable and efficient life, prices continue to rise except where the government intervenes and fixes a maximum beyond which they may not legally go. When the government fixes maximum prices it must at the same times establish priorities, classifying industries into the essential, the less essential, the desirable and the superfluous, and then by the creation of food commissions and fuel administrations not only see that its scales of prices are observed but also that production is stimulated or consumption curtailed or both as the occasion demands.

While commodities have been growing, relatively speaking, scarce and dear, money has as a direct result of the war been growing plentiful and cheap. It will be remembered that a part of the balance of trade in our favor has been settled by the importation of gold, thus making the supply of the basic money more abundant than ever before. From the beginning of the war, our financiers as well as those of England and France have been trying to prevent the importation of gold by the United States for the reason that such action causes prices to rise and thus interferes with the sale of our foodstuffs and other commodities which we desire to sell and the European nations at war desire to buy. It was for this reason that the British and French governments sent a joint commission to this country in the autumn of 1915 to confer with our government and our financiers with the result that arrangements were concluded by which a series of secured loans were provided for, thus permitting the sale of our exports without at the same drawing gold from England and France into this country. Notwithstanding all efforts made to check the flow of gold toward the United States, so strong are the natural economic forces that the importation of this precious metal, while seriously interfered with, has never been entirely stopped. Between 8 Jan. 1915 and 22 June 1917, over $1,600,000,000 in gold was imported into the United States from various foreign countries, the larger part of it coming from the nations at war. From the beginning of the war to 10 Aug. 1918, the net gain in our stock of gold resulting from the large excess of imports over exports is over one billion dollars worth.

INTERNATIONAL MOVEMENT OF GOLD

(In millions of dollars.)

Period	Imports	Exports	Excess of Imports
Aug. 1, to Dec. 31, 1914..	23,253	104,972	*81,719
Jan. 1, " " 1915..	451,955	31,426	420,529
Jan. 1, " " 1916..	685,745	155,793	529,952
Jan. 1, " " 1917..	553,713	372,171	181,542
Jan. 1, " Aug. 10, 1918..	52,971	29,268	23,703
	1,767,637	693,630	1,074,007

*Excess of exports.

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ECONOMY, Pa., village in Beaver County, on the Ohio River, and the Pennsylvania Railroad, 20 miles northwest of Pittsburgh. The first settlements were made by a colony of «Harmonists» who had formerly lived in Pennsylvania, then moved to Indiana, but returned and founded Economy in 1825. Pop. 860. See HARMONISTS.

* Cf. Miss Helen Frazer's recent report on "Women in British Industry."

ECRÉVISSE, the French name for crayfish (q.v.).

ECSTASY, an intense emotional state in which the scope of consciousness appears on introspection to lack all differentiation. It is characteristic of religious devotees. Mysticism is the opinion that ecstasy is a cognitive state, and mystics usually assert that the truest knowledge, or even the only true knowledge, is that acquired in a state of ecstasy. Ecstasy is not confined to any one religion nor to any one state of civilization — it is shared by the Buddhist monk, the Hindu yogi, the Moslem dervish, the Neo-Platonic sage, the Jewish cabalist, the early Christian martyr, the Swedenborgian and the medicine-man of the Amazonian savage. It is of the most varied nature as to its causes, its physiological and psychological concomitants, and the interpretation which it receives. Intoxicants, wild orgiastic dances, intent gazing at the navel or crystal globe, the mortification of the flesh, strange postures, the droning repetition of sacred words — all these devices and many others are employed to sweep from the field of consciousness all sharply-bounded ideas of particular things, and to lead the soul into a contemplation which finds all its demands satisfied within itself. The state of ecstasy attained by any of these means shows in its concomitants an intimate association with hypnotic phenomena — it is accompanied in certain cases by anæsthesia, the stigmata of the saints, loud irrepressible cries or frenzied dances and visions of the most varied kinds. In the Occident, ecstasy is oftenest interpreted as a direct communion with God, an unmediated entrance into the inmost heart of things. The less theistically inclined Hindu regards his ecstatic state rather as a sloughing off of the appearances of Being and even of the will to be, so that the soul floats away into the blissful non-existence called Nirvana. There are many cases where states of an essentially ecstatic character have been attributed to demoniac possession.

Ecstasy is closely related to other forms of very intense emotion. The ecstasy of the Moslem fanatic is above all a warlike passion, a desire to carry jehad into the lands of the unbeliever. Ecstasy of the orgiastic variety has very commonly a strong sexual element, as the cult of Dionysos bears witness. The deliberate evocation of ecstasy as a means of inducing a pleasurable excitement is by no means unknown even within the Christian faith, as is shown by the circumstances of many religious revivals. Ecstasy may be associated with objects other than those of religion. Intense æsthetic contemplation often leads to an absorption of the spectator in the work of art so complete as to deserve the name of ecstasy. In such a case the emotional effect of the work becomes so intense as to blot out all thought of the detail by which this effect is conveyed.

The cognitive value of ecstasy is very difficult to determine. It is certainly impossible to refute by recourse to the processes of consecutive thought what purports to be the object of a knowledge higher than thought and independent of its norms. Nevertheless, this logical irrefutability of mysticism is by no means a proof of its validity. The fact that the mystic believes with the utmost faith that he has been in communion with God does not in the least show that his mystical experience has not merely been a general sense of well-being, combined with the apparently amorphous mental content of one in a state of partial auto-hypnosis. So long as the mystic keeps his worlds of descriptive knowledge and of revelation sharply distinct, whether to follow him is a matter for each to decide for himself. However, much of the discursive knowledge that the mystic accepts as guaranteed by his mystical experience is not contained in the mystical experience itself, which is for the most part non-discursive in nature. The transition between the mystical vision, such as that which appeared to Moses on Sinai, and its interpretation in discourse — the Ten Commandments — is subject to a criticism on the part of reason, to precisely the same extent as any other transition from one item of knowledge to another. The weakest link in the chain that leads from the state of ecstasy to the dogma which claims to have been revealed in this state is the first step from direct immediacy to descriptive knowledge.

Ecstatic states appear frequently as psychopathic phenomena. Trances are characteristic of hysteria and catalepsy. In general, mystical experiences are most common among those who are abnormal in their mental make-up, or are weak by constitution or long illness, or have recently undergone some strong emotional shock. (See MYSTICISM; TRANCE). Consult Achelis, T., 'Die Ekstase' (Berlin 1902); Granger, F., 'The Soul of a Christian' (London 1906); Inge, W. R., 'Christian Mysticism' (Oxford 1899); James, 'Varieties of Religious Experience' (New York 1902); Janet, P., 'L'état mental des hystériques' (Paris 1893-94; tr. New York 1901); Récéjac, E., 'Essai sur les fondements de la connaissance mystique' (Paris 1897); Ribot, 'Les maladies de la memoire' (Paris 1881); Starbuck, E. D., 'Psychology of Religion' (London 1899); Underhill, E., 'Mysticism' (London 1911).

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ECTHYMA, ĕk-thī'mą, a complication of a number of general disorders manifesting itself as a form of pustular inflammation of the skin, particularly distributed on the extremities, the lower especially, the neck and trunk also often being affected. As a rule the affection begins as a small pimple which takes a rounded outline unless scratched. This pimple develops into an ulcer which is covered with a thick dark crust. The ulcer heals slowly and there is a small scar resulting. The development of the disease is slow, usually running a fortnight, and the pimple may be single or appear in crops. There is burning and pain. The common cause of ecthyma is diminished bodily resistance, such as is found in starvation or in syphilis, tuberculosis, diabetes or anæmia.

ECTODERM, the outer cellular layer of the embryo. See EMBRYOLOGY.

ECTROPION, or **ECTROPIUM,** a Greek term meaning an everted eyelid, a turning outward; an abnormal eversion of the eyelids. It is most frequent in the lower lid. Acute ectropion is due to swelling of the conjunctiva or spasm of the orbiculosis palpebraum muscle. Chronic ectropion is due to scare, paralysis of the seventh nerve or projection of the eyeball. Senile ectropion is due to shrinking of the tissues of the eyelid. While in acute cases due to swelling ectropion may be treated by

means calculated to reduce this swelling, in chronic cases a plastic operation is the only means of relief.

ECUADOR, a South American republic, bounded on the north and northeast by Colombia, and on the southeast and south by Peru, and on the west by the Pacific Ocean. The area, including the Galapagos Islands, is about 120,000 square miles.

The cordilleras of the Andes traverse Ecuador, running nearly north and south, with elevated plains between the eastern and western mountains, some of the latter forming a sequence that has suggested to geographers two parallel chains. Though there are not here the highest single peaks in the world, or even in South America, there are nowhere else so many peaks of very great height, forming a group. Their equatorial situation gives to these masses of granite, gneiss, schist, trachyte, porphyry, volcanic detritus wholly exceptional contrasts in temperature. This region has been in the past, and is probably to-day, more subject to volcanic disturbances than any other in South America. As an offset to the group of high peaks, the Andean ridges sink downward, forming the lowest pass at any point between Colombia and the southern division of the Andes. The principal rivers of the lowlands of western Ecuador, running from the central region of mountains and high plains to the Pacific, are the Guayas and the Esmeralda. The former empties into the Gulf of Guayaquil. In the eastern lowlands, the Napo and its tributaries belong to the Amazon River-system. There are numerous small lakes.

The mean temperature of the coast at Guayaquil, etc., is 80° F., that of the interior ranges from 95° F. in the lower valleys to 65° F. or even 50° F. on the plateaus, according to the altitude. The lower slopes of the mountains are torrid; the highest crests are snow-clad. The elevated valleys of the Andes have a very salubrious climate. They lie at an altitude of from 7,500 to 9,000 feet, where the temperature is moderate and fever unknown. The climate of the capital is temperate and springlike throughout the year, with little variation and it is said to be one of the best in the world for the cure of tuberculosis. There are two seasons only, the rainy lasting from December to May, and the dry from June to November. The first meteorological station in Ecuador was established in 1915. It has since been in successful operation at the Quinta Normal (Agricultural School), near Ambato. Substations are now established at Sangolqui, Saquimalag, Latacunga, Pansaleo, Mulalillo, Pillaro, Palate, Pelileo, Banos, Pilahuin, La Victoria and El Puyo. They are in charge of the director of the Quinta Normal, where the data are computed and reduced to tables each month, which are published in the *Bulletin* of the school.

Petroleum, sulphur, gold, platinum, coal, copper, mercury, lead and iron are plentiful in Ecuador, but of these gold alone figures in the list of principal exports. The Zaruma mines, province of El Oro, are worked on an extensive scale by an American company. That district contains numerous gold-bearing quartz veins, which were worked by the Spaniards 100 years ago. Along the Santiago, Cochabibi and Uimbi rivers in the province of Esmeraldas there are placer deposits of gold and platinum is found in conjunction with gold in the Esmeraldas washings. Silver is exported to a small extent.

History.— The Quito Indians, who held the country near the present capital, were conquered, perhaps in the 10th century, by a more warlike race led by chiefs called Scyris. These in turn yielded to the Incas of Peru. On the death of Inca Huayna-Capac, the empire was divided between his two sons, Atahualpa and Huascar. The former, whose mother was a Scyri princess, received the Quito kingdom; Cuzco and the southern empire were given to the latter. War broke out between the brothers shortly before the Spaniards under Francisco Pizarro arrived upon the scene, and this civil strife made possible the conquest of a great nation by a handful of foreign adventurers. (See PERU). Benalcazar, the famous Spanish captain, completed the conquest of the Scyri kingdom and seized the city of Quito (1534). Between 1564 and 1820 this region was administered as a presidency; and 36 presidents exercised authority there as representatives of Spain before the series of "presidents of the republic" began. Quito's first demonstration in favor of independence, 10 Aug. 1809, was quickly and savagely repressed. Guayaquil was more fortunate in her belated attempt (9 Oct. 1820). A campaign which resulted in the capture of Quito, after the battle of Pichincha, was organized by a triumvirate whose members were the poet, José Joaquin de Olmedo, the merchant, F. Roca, and the soldier, Rafael Jimena. The battle of Pichincha was won for the patriots by the Venezuelan general, Antonio de Sucre, Bolivar's lieutenant. The territory thus liberated was naturally drawn into the Colombian federation, which Bolivar dominated for a time. (See COLOMBIA). In 1830, after the dissolution of that greater Colombia, Ecuador became an independent republic. The convention of Riobamba placed Gen. Juan José Flores at the head of the government. His successor (1835–39) was Vicente Rocafuerte. Flores was again in power from 1839 to 1845 and, with the approval of many partisans, tried to secure a much longer term and dictatorial powers. A second triumvirate, composed of Olmedo, Roca and Noboa, carried on the government until a convention was held at Cuenca. This convention elected Vicente Ramón Roca, who served as President from 1845 to 1849. Vice-President Acásubi assumed the Presidency when Congress and the country could not agree upon a candidate; the country, however, continued to be disturbed until 1851, when Diego Noboa was chosen by a constituent assembly. In the following year he was displaced by Gen. José Maria Urvina, at the head of a successful revolution. Urvina was President until 1856. Slavery was abolished during his term. Gen. Francisco Robles followed (1856–59). During the next two years the country had a varied experience: war with Peru, the dictatorship of General Franco and the provisional government of Gabriel García Moreno. The convention of Quito elected García Moreno to the Presidency (1861–65). Gerónimo Carrion, elected in 1865, retired in 1867. Javiér Espinosa served from 1868 to 1869. García Moreno, as

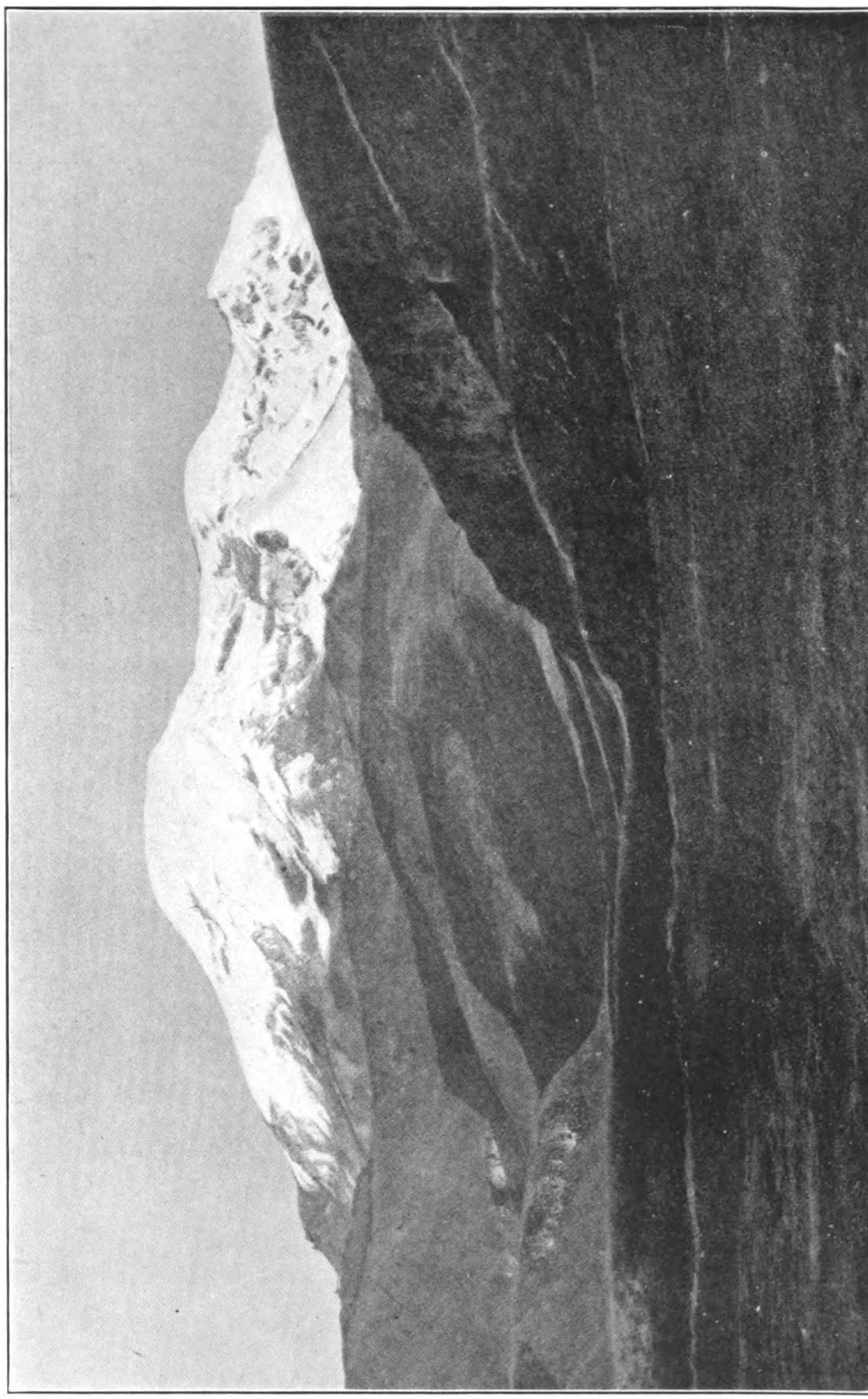
the leader of an insurrection, took office again (1869–73), and in 1873 secured re-election by the use of force. He was assassinated 6 Aug. 1875. Antonio Borrero, his successor, was driven from office by General Ignacio de Veintemilla in 1876. After the expiration of the legal period, President Veintemilla made himself dictator. José María Plácido Caamaño was President from 1884–88. He was succeeded by Antonio Flores 1888 to 1892; Luis Cordero from 1892 to 1895 — when he resigned to put an end to bloodshed. General Alfaro, at first "supreme chief," was legally elected in 1897. Gen. Leonidas Plaza Gutierrez succeeded him in 1901. In 1904 all religions were made equal before the law and eventually the nation was declared to be the owner of all church property. In 1905, the clericals elected their candidate for the Presidency, Lizardo Garcia, but he was overthrown in January 1906 by ex-President Alfaro, who was himself assassinated in Quito, together with a number of leaders. The President elected in 1912 was Gen. Leonidas Plaza Gutiérrez, who had been chief executive 1901–05. In 1913 contracts were made for the sanitation of Guayaquil. In 1914 government forces attacked the port of Esmeraldas, which the rebel leader, Colonel Concha, was holding, and a large part of the city was destroyed by fire. In 1915 difficulties of a serious financial character were discussed in connection with delayed payment of interest on bonds of the Guayaquil and Quito Railway and the lien on the entire customs receipts of the country held by European investors in that railway enterprise. Plaza was succeeded in 1916 by Alfredo B. Moreno, ex-Minister of Foreign Affairs and president of the Senate.

Government.— Congress meets at Quito every two years, usually on 10 August, for a period of 60 days, which may be extended for another 30 days. The President of the republic may also call an extraordinary session when deemed necessary or expedient. There are two chambers: the Senate of 32 members (two senators from each province; term four years) and the Chamber of Deputies of 48 members (one deputy for each 30,000 inhabitants; term, two years). Both senators and deputies are elected by direct popular vote, every citizen over 21 years of age who can read and write being entitled to vote. The President of the republic, elected for four years by direct vote of the people, cannot be re-elected until eight years have passed after expiration of the term of office. The Constitution now in force, dating from 23 Dec. 1906, is the twelfth promulgated since 1830. According to its provisions, Ecuador is a centralized republic. In the event of the death or disability of the President, the president of the Senate or of the Chamber of Deputies, in the order mentioned, exercises the executive power. The President's Cabinet is composed of the Minister of the Interior and Public Works, the Minister of Foreign Relations and Justice, the Minister of the Treasury and Public Credit, the Minister of Public Instruction, Post Offices and Telegraphs and the Minister of War and Navy. In addition to this Cabinet, there is a council of state which is consulted by the President in all important matters and which represents Congress when that body is not in session. It includes members of the Cabinet, the president of the Supreme Court, the president of the Court of Accounts, two senators, two deputies and three other citizens, the last seven members being elected by Congress. Under the Constitution foreigners enjoy the same guaranties and civil rights as the citizens of Ecuador. Freedom of thought, of worship and of the press is assured. Women may exercise all the rights granted to Ecuadorians, and also have the free administration of their property, even when they are married. Aliens may acquire property, also public lands, and may establish banking institutions under the same conditions as Ecuadorians. Public credit is guaranteed and funds set aside for the payment of public debt cannot be used for other purposes.

The local government is controlled by the central government. The local administrators, from the governors of the provinces down to the lieutenants of the parishes, are all appointed by the President. Chief towns of cantones have municipal councils, commonly of five members. There are rural (mounted) and urban police, with a director or chief in each provincial capital.

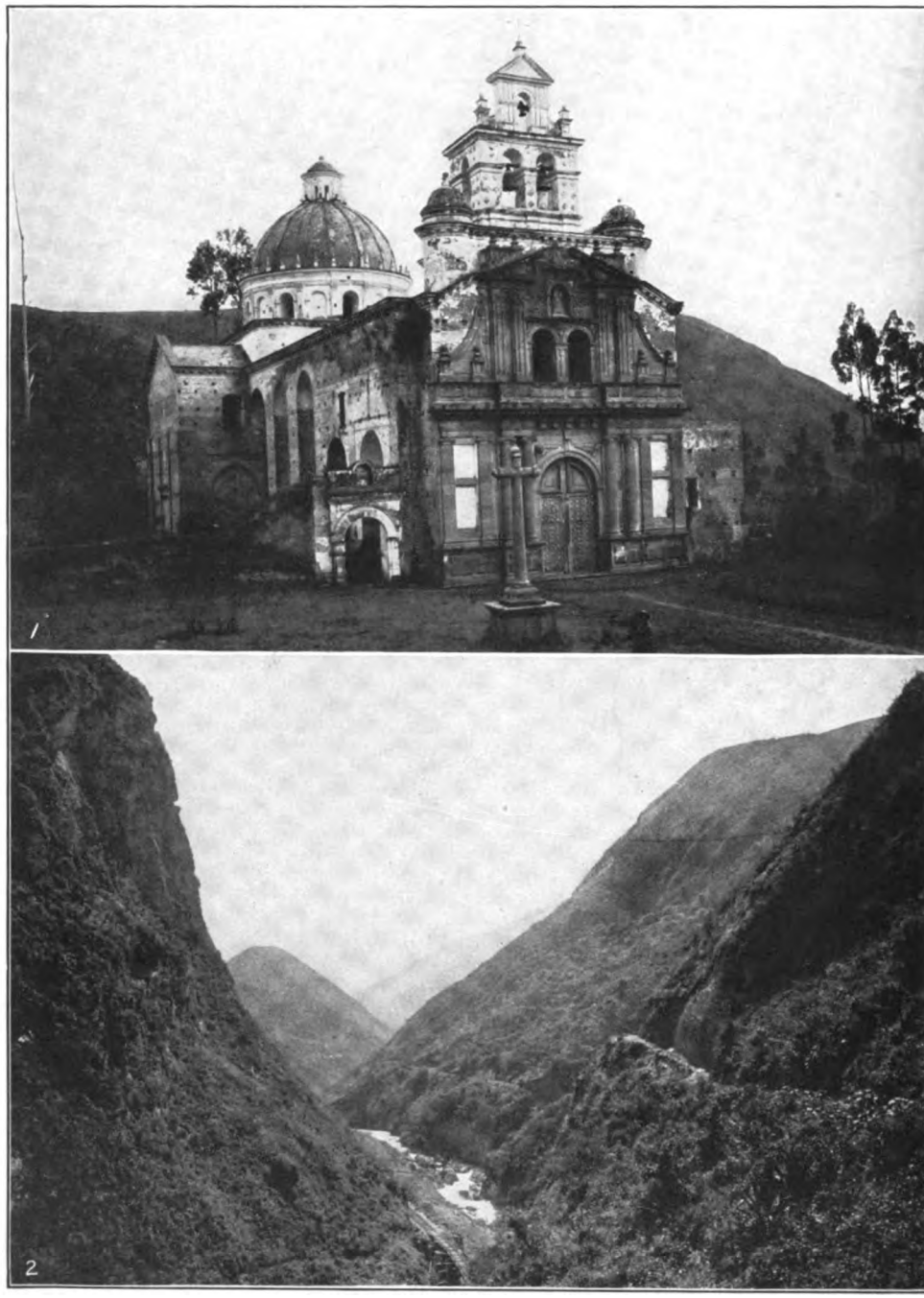
Ecuador's courts are the Supreme Court, at Quito (five justices, elected by Congress for a term of six years, attorney-general, two secretaries); Superior Courts at Quito, Guayaquil, Cuenca, Riobamba, Loja and Puertoviejo, the first two being composed of six judges and the last four of three judges each, all elected by Congress for the same term as the members of the Supreme Court; Court of Accounts at Quito (seven judges) empowered to audit and investigate all public accounts and expenditures, its members being elected by Congress for a term of similar length to that of the justices; municipal civil tribunals of the first instance at Quito, Guayaquil and Cuenca; fiscal judges for each province; judges of commerce in large towns; judges of mines, police and parishes. In the republic there are 33 cantonal and 359 parochial justices, and 85 solicitors admitted to practice. In criminal cases, trial by jury is provided for, but only in the larger towns.

Education.— Primary instruction is gratuitous and obligatory for children between 6 and 12 years of age. Among the subjects taught beside the familiar elementary branches are morality, religion and urbanity. In the boys' schools the Constitution of Ecuador is added; in those for girls, sewing and domestic economy. In 1916 there were about 1,600 public schools of primary grade, with 98,400 pupils. Secondary instruction is provided in 37 "colleges," with 371 professors and 4.500 students, the school year beginning 10 October and ending 30 July. The University at Quito, with associate universities at Cuenca and Guayaquil, has faculties of philosophy, *belles-lettres,* law, medicine, physical and natural sciences, mathematics and agriculture. There are nine schools of higher education with about 1,228 students. Schools of arts and crafts are found in the provinces of Pichincha, Leon, Chimborazo, Azuay, Loja and Guayas. Bahía has a commercial school. About $600,000 is expended yearly by the government on education. There are also numerous private schools in the republic.



MT. CHIMBORAZO

ECUADOR



1 Old Church at Quito

2 A Pass in the Andes; Guayaquil and Quito Railway

José Joaquin de Olmedo (b. Guayaquil 1780) and Juan Montalyo (b. Ambato 1833) are by Ecuadorians esteemed, the former the greatest poet, the latter the greatest prose writer of South America. Ecuador was also the birthplace of José Mejía, the "American Mirabeau," and of many historians, theologians, poets, romancers and critics whose works are highly regarded in Spain. The Ecuadorian Academy (founded 1875) is the chief of the literary associations of the republic.

Commerce, Finance and Agriculture.—The value of imports in 1914, the last normal year before the effect of the European War was felt in all Latin-America, was $8,402,767; of exports, $12,464,333; and the principal exports were: cacao, 47,210 tons; coffee, 2,980 tons; gold (in bars or dust), $365,324; "Panama" hats, $972,215; cattle hides, 811 tons; ivory nuts, 8,583 tons; rubber, 147 tons. The exports in 1915 were $12,740,000. The United States took exports valued at $3,588,130; France took $4,438,226; Germany, $860,302; United Kingdom, $1,230,555. Ecuador imported from the United States goods valued at $2,770,599; from the United Kingdom, $2,414,662; from Germany, $1,203,566; from France, $326,770. The value of imports in 1915 was $8,422,881; of exports, $12,882,402. The principal exports were cacao, 81,712,773 pounds, valued at $9,706,981; "Panama" hats, 300,375 pounds, valued at $839,027; gold, $530,591; ivory nuts, 20,094,925 pounds valued at $526,519; coffee, 5,116,161 pounds valued at $463,413; cattle hides, 1,971,243 pounds valued at $289,333; rubber, 564,943 pounds valued at $196,447; leaf tobacco, 584,868 pounds valued at $89,825; leather, 163,803 pounds valued at $27,410; bananas, 3,522,475 pounds valued at $33,575. The exports to the United States amounted to $5,674,291, to the United Kingdom $2,669,280, to France $1,175,972, to Spain $582,834, to the Netherlands $982,410, to Italy $598,590. Textiles other than silk formed the principal import item in 1915, amounting to $1,795,101. Other important articles imported were gold and silver coin to the value of $1,416,232, foodstuffs $1,257,294, hardware $581,521, clothing $301,418, mineral products $327,315, machinery and parts $277,970. The imports from the United States in 1915 totaled $3,209,608, those from the United Kingdom $3.353,333, those from Italy $399,961, Spain $330,867, France $246,728. United States ranked first in purchases from Ecuador for 1915, with the United Kingdom second and France third, while in imports the United Kingdom occupied first place, the United States a close second and France a distant third. Heavy purchases of materials for the sanitation of Guayaquil from the United Kingdom were largely responsible for the increased value of shipments from that country. Great increases were made by the United States in the sales of cotton piece goods, laundry soap, readymade clothing, straw hats, drugs and chemicals, paper, crackers and a number of others, including canned goods, which have secured a permanent entry into this market.

There were 185 vessels of 318,742 tons and two sailing vessels of 1,737 tons entered the ports of Ecuador during 1915, as compared with 162 steam vessels of 335,561 tons and seven sailing vessels of 12,125 tons during 1914. The exports from the port of Guayaquil in 1916 to the United States included 37,227,400 pounds of cacao, 175,143 pounds of coffee, 1,829,200 pounds of hides, 592,997 pounds of ivory nuts and 121,317 pounds of rubber. Of cacao the United Kingdom took 23,772,000 pounds, of hides 143,730 pounds and of ivory nuts 62,362 pounds. France took 10,095,225 pounds of cacao, 599,938 pounds of coffee, 29,378 pounds of hides and 219,205 pounds of ivory nuts. Spain took 4,242,700 pounds of cacao, 558,956 pounds of coffee, 42,091 pounds of hides, 78,375 pounds of ivory nuts and 10,683 pounds of rubber. Holland took 4,325,000 pounds of cacao and Chile 2,528,834 pounds of coffee. The total exports of the port were 81,756,910 pounds of cacao, 4,645,218 pounds of coffee, 2,044,399 pounds of hides, 1,101,017 pounds of ivory nuts and 132,000 pounds of rubber.

The monetary system is based on the gold standard, the unit of value being the *sucré* (weight 0.8136 grammes of gold .900 fine, or 0.73224 grammes of pure gold). The value of the sucré is $0.48665, currency of the United States; and the value of $1.00 American in terms of Ecuadorean currency is therefore $2.05484. The actual currency of the republic is gold, silver and banknotes, but the only legal tender is gold. The new coinage consists of the gold condor of 10 sucrés, weighing 8.136 grammes of gold .900 fine, or 7.3224 grammes of fine gold, equivalent to $4.866 in currency of the United States, or one pound sterling, English money. (Consult Cosby, J. T., 'Latin-American Monetary Systems and Exchange Conditions,' New York 1915). Ecuador has four banks of issue: In Guayaquil, Banco del Ecuador (capital 3,000,000 sucrés) and Banco Comercial y Agricola (capital 5,000,000 sucrés); in Quito, Banco de Pichincha (capital 1,500,000 sucrés); in Cuenca, Banco del Azuay (capital 400,000 sucrés). Other banks are the Banco Hipotecario (capital 1,000,000 sucrés) and the Banco Territorial (capital 750,000 sucrés). These are only mortgage loan banks. The fiscal revenues of Ecuador before the European War amounted to $10,000,000 American gold, derived chiefly from customs duties (on imports of $4,000,000 and on exports $2,600,000, alcohol tax $480,000, salt monopoly $360,000) and internal resources. (Consult 'Proceedings of the First Pan-American Financial Conference,' Washington 1915). The debt of the government to the local banks is partly consolidated, to be liquidated in 1927, and partly in current account. Beside this, the government owes a million of 6 per cent internal bonds and $1,500,000 of floating debt, making a total debt of about $6,500,000. The foreign debt proper amounts to $1,000,000 and the guarantee of the bonds of the Guayaquil and Quito Railway, Ecuador Central Railway and French Railway Company of Ecuador. The total debt of the republic in 1916 was $23,615,000.

The cultivated area is limited, owing to the lack of laborers; nevertheless Ecuador has considerable agricultural resources. A large variety of crops are grown and the soil is exceedingly fertile. Ecuador produces more cacao than any other country except the Gold Coast in Africa. It is grown principally in the provinces of Guayas, El Oro and Manabi. In 1914, 47,210 and in 1915, 40,000 metric tons were produced. Over 40,000,000 pounds of tagua (ivory

nut) are exported annually. Coffee is cultivated in several districts to the extent of several million pounds a year and considerable quantities are exported. Sugar cane and tobacco are grown on the lowlands of the coast. Of the former about 16,000,000 pounds are produced yearly, an amount which about satisfies the domestic demand. Rice, quina, maize, wheat, barley, oats and a number of medicinal and industrial plants are also grown to supply the home market and some are exported. The rubber tree is plentiful and this industry is growing fast, the rubber exported annually reaching nearly $1,000,000 in value. Alfalfa is cultivated and the pastoral industries are thriving.

Communications.— Sixty miles of the railway from Guayaquil to Quito were built before 1880, that is, from the coast to the village of Chimbo, at the base of the cordillera. A company organized in the United States completed the road (25 June 1908); passenger trains make the trip (297 miles) in two days. The line starts from Duran, across the Guayas River from Guayaquil and ascends the Andes to a height of 11,841 feet, when it descends to a height of about 9,000 feet and continues on to Quito. The gauge is 3 feet 6 inches and the rolling stock consists of about 25 locomotives and several hundred passenger and freight cars. The Central Railway, from Manta on the coast to Santa Ana, is in operation as far as Puertoviejo, 25 miles, and when complete will be 35 miles long. A railway connects Bahía, Caracas and Quito (186 miles). A number of other lines are authorized, among them being a 125-mile line from Ambato to the Curraray River, a line from Ambato to Banos, a line from Quito to a port on the Esmeraldas coast and one from Guayaquil to the coast. The total extent of the telegraph system is 5,482 miles with 204 offices. The Ecuadorian landing-station of the Central and South American Telegraph Company's cable is at Salinas, which was declared open as a minor port by executive decree 21 Aug. 1902. Quito and Guayaquil have telephone services; the latter a street car system. There are six wireless telegraph stations — two main ones at Quito and Guayaquil each, one on the coast to the north of Guayaquil and one on the Galápagos Islands and one each at Bolivar and Bahía. A score or more passenger vessels ply on the Guayas River and between Guayaquil and other coast towns. English steamships of the Pacific line and vessels of the Chilean line plying between Valparaiso and Panama call regularly at Guayaquil. There are about 200 post offices in the country and they handle yearly over 6,000,000 pieces of postal matter. The postal service is being gradually extended.

Some 20 steamers, as well as a number of sailing vessels, steam yachts, steam launches and gasoline launches maintain an active coast and river service, most of the numerous rivers of the country being navigable for considerable distances inland and affording excellent means of transportation. The Guayas River, at the mouth of which is the city and port of Guayaquil, is the most important of these waterways, being navigable for river steamers as far as Bodegas, 40 miles from Guayaquil, while smaller vessels can, during the wet season, reach Zapotal, some 200 miles inland. The Daule River is navigable for some 60 miles, the Vinces for 50 miles, while the Esmeraldas, Naranjal, Santa Rosa, Santiago and Mira rivers are all navigable during the rainy season for short distances, varying from 10 to 60 miles or more. The Amazón, which in Ecuador is given the name of Marañón River, is navigable almost in its entirety and thus the eastern slope of the Ecuadorian Andes may be reached by way of Brazil and the Amazón River and its tributaries.

Army and Navy.— In time of peace, the army consists of 7,810 officers and men, and reserves numbering possibly 100,000. The regular force is composed of 13 battalions of infantry, one regiment of cavalry, and 12 batteries of artillery, besides some departmental troops. These serve one year and then pass to the reserve and second line. The second line army has 135 infantry battalions, seven artillery regiments and 44 cavalry squadrons. The regular infantry have the Mauser rifle; the artillery have old-fashioned Krupps. Military service is obligatory from 18 to 32 years of age in the army, and from 32 to 45 in the national guard. The compulsory law, however, is not generally enforced. A mining and torpedo section, a sanitary section and a telegraph and telephone corps were created in 1910. The national guard includes companies of firemen — organizations which are especially numerous and influential in Guayaquil. The naval vessels are one cruiser of 600 tons, one torpedo gunboat of 56 tons, one torpedo boat destroyer of 1,000 tons and a transport, with three launches, with a total equipment of about 200 men.

The boundaries of the republic being in dispute, and a large part of Ecuador's claim being unexplored territory, estimates of the total number of inhabitants vary; but the republic contains about 2,000,000. Of these from one-half to three-fourths are Indians, about 600,000 half-breeds and only 205,000 pure whites. There is a small number of negroes.

The provinces of Ecuador, with their capitals and populations, are as follows:

Provinces	Capital	Inhabitants
Azuay	Cuenca	50,000
Bolívar	Guaranda	6,000
Cañar	Azogues	5,000
Carchi	Tulcan	20,000
Chimborazo	Riobamba	22,000
Esmeraldas	Esmeraldas	5,000
Galápagos	San Cristóbal	300
Guayas	Guayaquil	105,000
Imbabura	Ibarra	10,000
Leon	Latacunga	18,000
Loja	Loja	14,000
Manabi	Puertoviejo	10,000
Oriente	Archidona	5,000
Oro	Machala	5,000
Pichincha	Quito	80,000
Los Ríos	Babahoyo	5,000
Tungurahua	Ambato	10,000

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MARRION WILCOX.

ECUMENICAL CONFERENCE. An ecclesiastical body meeting once in 10 years. It is composed of representatives of the various Methodist bodies throughout the world. It has no legislative powers. The first one met in London, 7–20 Sept. 1881; nearly 400 delegates represented 28 bodies. The second met in Washington, D. C., 7–20 Oct. 1891. Twenty-nine bodies were represented and the total delegation numbered 485. The third conference met in London, 4–17 Sept. 1901. Twenty-four bodies sent 471 delegates. The fourth conference met in Toronto, Canada, 4–17 Oct. 1911. Twenty-one denominations were represented by 500 delegates. The procedings include the reading of papers on denominational history, polity and outlook and discussions of the same.

ECZEMA, ĕk'zĕ-mạ, an acute or chronic disease of the skin, showing a vast variety of changes in the skin itself, and usually accompanied by intense itching, burning or pain. The changes in the skin at first are usually marked by redness, papules, then small vesicles or pustules which later become crusted and dry; or the surface is weeping. Infiltrated and scaly patches are common. All of the different forms of eczema (and no less than a dozen varieties are described by skin specialists) have certain definite changes occurring in the skin. There is usually swelling, congestion and increase of temperature locally. There is almost invariably an exudation of fluid into the tissues, with the formation of vesicles and pustules, as described. There is further a certain amount of plastic exudation which produces in the skin papulous areas that are thickened and infiltrated. Finally there are the subjective symptoms of itching, which may be only a slight tingling or prickling sensation, or may be so intense as to demand continued and deep scratching until bleeding or oozing takes place. This itching is, as a rule, intermittent in character, being almost invariably worse at night when the patient is covered, the heat of the body causing the aggravation. Sometimes exposure to cold brings about intense itching. The disease usually runs an acute course, and may be limited to one region of the body, or may be general. Its general tendency is to progress rather than to get well. It is perhaps one of the most obstinate of all skin diseases, and at the same time one of the most difficult to diagnose and to treat. The causes are probably many. In general the fundamental pathology seems to be an over-active function of autonomic nerve stimuli going to the skin. This over-autonomic (parasympathetic) activity may be a primary one —or be an imbalance from subacting sympathetic stimuli. The study of this lack of balance may involve a wide search for physicochemical, sensori motor or phychic disturbances, and a truly helpful therapy must take into account these underlying features. Inasmuch as orthodox medicine has found the disorder very intractable it would seem to indicate the lack of deep consideration of the dynamic factors in human pathology — notably the importance of mental as well as so-called physical factors. The treatment of each case is a particular study. Sometimes the disease is beyond the power of the best skin specialist; usually such cases are psychogenic in their origin and the average skin specialist is too uneducated to know anything about mental causes. At other times corrections of minute errors in diet will bring about cure. So far as household remedies are concerned, only those that can relieve the itching are deserving of notice in this place. One of the best of these is carbolic acid in weak solution — 2 to 3 per cent. This may be applied on a bit of absorbent gauze, special care being taken not to enclose a particular part completely with the weak carbolic acid. Bland non-irritating powders, such as calamine and oxide of zinc are often useful. When the disease becomes chronic it is apt to be extremely obstinate. Many of the chronic cases rest upon an endocrinopathic basis, which in its turn often depends upon neurotic disturbance.

EDAM, ē'dăm, Holland, town 12 miles north-northeast of Amsterdam, and about a mile from the western shore of the Zuyder-Zee, with which it is connected by a canal. This place is chiefly noted for its trade in cheese, of which nearly 1,000,000 pounds are annually sold in its market. Other industries are shopbuilding, leather manufacture, rope and sail making. The town was once fortified, and has still a wall with seven gates. Its Reformed Church of Saint Nicholas, with large painted windows, is among the finest in North Holland. Pop. 6,444.

EDDAS, The. The name given to two collections of early Icelandic literature, very unlike in character. The 'Poetic Edda' consists of a series of lays in various metres, most of them celebrating the deeds of gods and heroes; the 'Prose Edda' is a manual of instruction for poets, in which information in regard to the matter and form of poetry is given in prose, with some illustrations in verse. The 'Poetic Edda' is the work of different authors, no one of whom is known by name. Internal evidence shows that the lays which compose it date, in their present form, from the 9th to the 12th centuries inclusive; most of them belonging, perhaps, in the 10th. They were united into a collection by an unknown Icelander in the early 13th century. His transcript is lost, but the material is extant in later copies. The best and oldest manuscript is the Codex Regius, now in the Royal Library at Copenhagen. This dates from the end of the 13th century, but was not recovered until the 17th century, by the Icelandic bishop Brynjolf Sveinsson. He called it the 'Edda of Sæmund the Wise,' because he thought that a learned Icelander of the 12th century, Sæmund Sigfusson, might be the author or collector of the pieces. Modern criticism has shown this to be impossible, but the term 'Sæmundar Edda' is still sometimes erroneously used. The author of the 'Prose Edda' was the Icelander Snorri Sturluson, (1178–1241), a literary man of great distinction. Hence the 'Prose Edda' is often called the 'Snorra Edda,' and sometimes the 'Younger Edda,' to distinguish it from the Elder or

Poetic collection. The term "Edda" belongs properly only to the work of Snorri. It probably means "the book of Oddi,"—a little place in Iceland where Snorri and Sæmund lived. "Edda" also signifies "great-grandmother"; hence the collection has been fancifully interpreted as tales told by an old woman to her descendants. Again, it has often been understood as "a system of poetry." Whatever its origin, the term has won its way to the best modern usage.

The 'Poetic Edda' falls roughly into two divisions, treating respectively of gods and heroes. The Lays of the Gods differ a great deal from each other in character and technic. The 'Voluspa,' or 'Prophecy of the Sibyl,' is an account of the creation and fated destruction of the world. 'Balder's Dreams' has a similar setting; the prophetess gives Odin information about the future, explaining the evil dreams that have afflicted the god Balder. The 'Lay of Thrym' is a humorous piece, narrating the stealing of Thor's hammer and its recovery by Loki. Similar in character is the 'Lay of Hymir,' in which Thor goes out fishing on the wintry sea with the giant Hymir, and catches the world-serpent which lies at the bottom, encircling the earth. In the 'Word-Combat of Loki,' the treacherous god recalls, at a banquet from which he has been excluded, disreputable incidents in the lives of the deities, until silenced by Thor. The 'Lay of Skirnir' relates a love-affair of the god Frey. Several pieces consist of moral reflections, set in a narrative framework. In the 'Lay of Hoarbeard' and the 'Lay of Vafthruthnir,' Odin shows his supremacy in contests of wisdom; in the 'Lay of Allwise' the victory is with Thor, who keeps the dwarf Allwise above ground after sunrise, so that he is turned to stone. In the 'Lay of Grimnir' Odin utters wisdom in disguise. The 'Havamal,' the 'Words of the Mighty One,' is a collection of gnomic material. The 'Lay of Rig' and the 'Lay of Hyndla,' of minor importance, and the 'Lay of Swipdag,' with the setting of a love-story, but uniting the prophecy and the word-contest, complete the collection, except for material of little significance.

With the exception of the 'Lay of Weland,' the celebrated smith, and three 'Helgi-Lays,' the second section is concerned with the personages connected with the great story of Sigurd, the German Siegfried, which is here much extended. A short prose section, 'Sinfjotli's Death,' and the 'Prophecy of Gripir,' lead to the 'Lay of Regin' and the 'Lay of Fafnir.' Sigurd slays the dragon and gets the Nibelungen gold. In the 'Lay of Sigrdrifa' (Brynhild) his meeting with the Valkyrie is described; and the well-known story is continued in two lays centering about Sigurd, three concerned with Gudrun and two describing the tragedy at the court of Atli. The 'Lament of Oddrun' deals with the love of the sister of Atli for Gunnar. The 'Exhortation of Gudrun' and the 'Lay of Hamthir' describe events after Gudrun's marriage to Jonakr, particularly the pathetic tale of Swanhild. The 'Lays of the Heroes' often attain a high level of tragic power. Dramatic moments are emphasized and details omitted and the stanzaic structure heightens the effect of intensity, much as in the traditional ballad-verse. The whole is very different from the tranquil and ample narrative of Anglo-Saxon poetry. Mythological interpretations of the poems as allegories of the processes of nature must be received with caution. The hypothesis of Sophus Bugge that many of the lays have their origins in classical and Christian traditions has not met with general acceptance.

After a Prologue, the 'Prose Edda' narrates the 'Beguiling of Gylfi,' in which, under a narrative disguise, information about mythology and cosmogony is set forth. In the 'Narratives of Bragi,' the god of poetry tells stories of Odin and Thor. The section entitled 'The Poesy of Skalds' treats of methods of poetic expression; and in order to illustrate metaphor and allusion, much of interest in Scandinavian mythology and story is given to the reader. The concluding portion, the 'Hattatal,' consists, besides explanatory material, of a poem on King Hakon Hakonarson in more than a hundred stanzas, each in a different metre. This latter section is without much interest for the modern reader, but earlier parts of the work, though intended mainly for technical instruction in the making of skaldic verse, are often highly picturesque and of great value in the study of Scandinavian traditions.

Bibliography.—The Lays of the Gods have been translated by Olive Bray (Viking Club, London 1908); the second volume to contain the Lays of Heroes, has not yet appeared. The German translation by H. Gering of the entire Poetic Edda may be used in default of an English version. The best portions of the 'Prose Edda' have been translated by A. G. Brodeur (New York 1916).

WILLIAM WITHERLE LAWRENCE,
Professor of English, Columbia University.

EDDY, Clarence, American organist and composer: b. Greenfield, Mass., 23 June 1851. He studied under Buck in Hartford, counterpoint under Haupt, and piano under Loeschhorn in Berlin. In 1874–76 he was organist of the First Congregational Church, Chicago; afterward organist and choirmaster of the First Presbyterian Church for 17 years and from 1875 to 1908 was director of the Hershey School of Musical Art. In 1877–79 he gave a series of 100 organ recitals, with entirely different programs, a memorable achievement in American musical annals. He has played at several expositions in America and abroad, and has given recitals in the principal American and European cities. He has composed several works for the organ and has written 'The Church and Concert Organist' (3 vols., 1885); 'The Organ in Church' (1887); 'Concert Pieces for the Organ' (1889), and a translation of Haupt's 'Counterpoint, Fugue, and Double Counterpoint' (1876).

EDDY, Henry Turner, American scientist: b. Stoughton, Mass., 9 June 1844. He was educated at Yale and later took a further scientific course in Berlin and Paris. After holding a professorship in mathematics, astronomy and civil engineering at the University of Cincinnati 1874–90, and acting as dean of the academic faculty of that institution (1874–77, 1884–89), he became its president in 1890. He was also president of the Rose Polytechnic Institute at Terra Haute, Ind., from 1891 to 1894, when he accepted the chair of engineering and mechanics at the University of Minnesota. He

became dean of the Graduate School of the latter university in 1906, and professor and dean emeritus in 1912. He published 'Analytical Geometry' (1874); 'Researches in Graphical Statics' (1878); 'Thermodynamics' (1879); 'Neue Constructionen aus der graphischen Statik' (1880); 'Maximum Stresses under Concentrated Loads' (1890); 'Theory of the Flexure and Strength of Rectangular Flat Plates Applied to Reinforced Concrete Floor Slabs' (1913); 'Concrete Steel Construction' (1914); and numerous scientific and technical papers.

EDDY, Mary Baker, discoverer and founder of the religion (theology and practice) which she named Christian Science, and founder of the Church of Christ, Scientist. Mrs. Eddy (at first Mary Baker) was born at Bow, near Concord, N. H., 16 July 1821, the sixth and youngest child of Mark and Abigail Baker. One of her ancestors, John Baker, was among the earliest settlers of the colony of Massachusetts Bay (at Charlestown in 1634). One of her great-grandfathers was Capt. Joseph Baker, who earned his title and gained an honorable name in the service of the colony of New Hampshire. Other soldiers of renown among Mrs. Eddy's relatives were Capt. John Lovewell, hero of a war with Indians during the colonial period, Gen. Henry Knox of the War for American Independence, and Gen. John McNeil of the War of 1812. Her immediate family were people of considerable prominence and prosperity: her father a large landholder and well-known citizen; one of her brothers, Col. George Sullivan Baker, a public man and member of the staff of the governor of New Hampshire; another brother, the Hon. Albert Baker, a lawyer and member of the New Hampshire legislature; a cousin, the Hon. Henry M. Baker, a lawyer and member of Congress from New Hampshire.

The home in which Mrs. Eddy was reared was one of refinement and religious devotion. Her parents were members of the Congregational Church, and their hospitality was frequently enjoyed by the clergy of this and other denominations; and in the discussions of religious subjects which often occurred in the home Mrs. Eddy took an interest and participated in a manner that was seen to be unusual and far in advance of her years. To her mother and her brother Albert, however, Mrs. Eddy gave the most credit for her early training. Her mother was a woman of evident gentility and marked spirituality; her brother Albert a graduate of Dartmouth College, studied law with Franklin Pierce (afterward President of the United States), and became a young man of extraordinary promise before his decease at the age of 31.

As a child, Mrs. Eddy was frail and subject to illness. This kept her from attending school regularly; yet she was studious, and with the aid of tutors she gained an education equal to that which was then regarded as liberal. One of her tutors was the Rev. Enoch Corser, pastor of the Congregational church at Tilton, N. H., who supplemented his pastoral duties, sometimes by teaching in the local academy and sometimes by tutoring. Mr. Corser's contact with Mrs. Eddy began soon after she removed with her parents from Bow to Tilton in 1836 when she was 15 years old, and continued for six or seven years. He departed this life before she became famous, but an interesting and significant expression of his opinion was preserved and related by his son, Mr. S. B. G. Corser. Writing from Boscowan, N. H., in 1902, the younger Mr. Corser said: "My father, the Rev. Enoch Corser, was pastor of the Congregational church at Northfield and Tilton (then Sanbornton Bridge) from 1837 to 1843, with which the Baker family was connected. If I remember rightly Mrs. Eddy was about 15 when I first met her, she being several years younger than myself. I well remember her gift of expression, which was very marked. As her pastor, and for a time her teacher, my father held her in the highest esteem; in fact he considered her, even at an early age, superior both intellectually and spiritually to any other woman in Tilton, and greatly enjoyed talking with her. She and my father used to converse on deep subjects frequently. I remember her admiration for him, and she stands out in my recollection as his brightest pupil. He predicted for Mrs. Eddy a great future and spoke of her as an intellectual and spiritual genius."

From her childhood or girlhood until more than a decade after her discovery of Christian Science, Mrs. Eddy was a member of the Congregational Church. Applying for membership at Bow when she was 12 years old, she was examined and given some assurance of acceptance in spite of the issue she took with the then-prevalent doctrine of unconditional election or predestination. Whether she was formally admitted to membership at this time, or not until five years later at Tilton, is a question left uncertain by the records of these churches. It was at this earlier time, when Mrs. Eddy was about 12 years old, that she first experienced the power of prayer to deliver from sickness. Perturbed by the teaching that her brothers and sisters and she were already numbered among those who were to be saved or lost, she became ill with what the family doctor pronounced a fever. In her autobiography, 'Retrospection and Introspection' (p. 13), Mrs. Eddy thus related her healing: "My mother, as she bathed my burning temples, bade me lean on God's love, which would give me rest, if I went to Him in prayer, as I was wont to do, seeking His guidance. I prayed; and a soft glow of ineffable joy came over me. The fever was gone, and I rose and dressed myself, in a normal condition of health. Mother saw this, and was glad. The physician marvelled; and the 'horrible decree' of predestination — as John Calvin rightly called his own tenet — forever lost its power over me."

Mrs. Eddy was married three times: first to Maj. George W. Glover, a native of New Hampshire who had removed to Charleston, S. C., and become a successful contractor and builder. His military title was gained by service in the militia and on the governor's staff in South Carolina. This marriage occurred in 1843, when Mrs. Eddy was 22 years old. It was dissolved in less than a year by the death of Major Glover. Ten years later (in 1853) Mrs. Eddy married Dr. Daniel S. Patterson, a dentist of Franklin, N. H. In 1873, after her removal to Lynn, Mass., and her discovery of Christian Science, she obtained a divorce from him on account of long-continued desertion due

to his infidelity. In 1877, after she had begun the practice and teaching of Christian Science, Mrs. Eddy married Asa Gilbert Eddy of Londonderry, Vt., the first of her students to engage in the public practice of Christian Science healing. He died five years later (in 1882) after having helped to sustain Mrs. Eddy during the period in which the Church of Christ, Scientist, was organized and the Christian Science movement encountered its first active opposition.

During Mrs. Eddy's first widowhood (1844–53) she developed her fluency of expression and her earning capacity by writing occasional verses and by contributing articles for periodicals on topics of public interest. Her ability of this kind was recognized by an offer of $3,000 a year (a large salary at that time) to become associate editor of the *Odd Fellows Magazine*, then edited by the Rev. Richard Rust, and by the inclusion of two poems from her pen in an anthology of poems and essays by New Hampshire authors which was published first at Manchester in 1850 and again at Boston in 1856. During the same period, Mrs. Eddy served as substitute teacher in the Tilton Academy and experimented with a school for children somewhat like the modern kindergarten. The period between Mrs. Eddy's second marriage and her discovery of Christian Science (1853–66) was one of following the fortunes of an inconstant or faithless husband and enduring the combined difficulties of desertion and ill health.

The course of events that led to her discovery of Christian Science was described by Mrs. Eddy as follows: "During twenty years prior to my discovery I had been trying to trace all physical effects to a mental cause; and in the latter part of 1866 I gained the scientific certainty that all causation was Mind, and every effect a mental phenomenon. My immediate recovery from the effects of an injury caused by an accident, an injury that neither medicine nor surgery could reach, was the falling apple that led me to the discovery how to be well myself, and how to make others so" ('Retrospection and Introspection,' p. 24). The accident here spoken of occurred in the evening of 1 Feb. 1866, as Mrs. Eddy was returning from a Good Templars meeting in Lynn, Mass., to her home in the suburb of Swamscott. The contemporaneous account of it furnished by the Lynn *Reporter* said that she fell on the ice, was taken in an insensible condition to a near-by residence, where she was examined by a physician and cared for during the night; that the doctor found her injuries to be internal and of a serious nature, and that she was removed to her home the following afternoon in a critical condition.

Mrs. Eddy has described her recovery from this injury as follows: "On the third day thereafter, I called for my Bible, and opened it at Matthew ix, 2. As I read, the healing Truth dawned upon my sense; and the result was that I rose, dressed myself, and ever after was in better health than I had before enjoyed. That short experience included a glimpse of the great fact that I have ever since tried to make plain to others, namely, Life in and of Spirit; this Life being the sole reality of existence" ('Miscellaneous Writings,' p. 24). This incident was the occasion for beginning years of profound study of the Scriptures. Of this search and research she has said: "I must know the Science of this healing, and I won my way to absolute conclusions through divine revelation, reason and demonstration. The revelation of Truth in the understanding came to me gradually and apparently through divine power. When a new spiritual idea is borne to earth, the prophetic Scripture of Isaiah is renewedly fulfilled: 'Unto us a child is born, . . . and his name shall be called Wonderful' " ('Science and Health,' p. 109).

The next events of major importance in the life of Mrs. Eddy were the writing and the printing of the textbook of Christian Science, 'Science and Health with Key to the Scriptures.' After writing a statement of her discovery and finding no publisher for it, she became her own publisher and brought out the first edition of 1,000 copies (at Boston in 1875). Copies of this edition now sell at many times their original price, then they were difficult to sell at all, and were not always welcome as gifts. Yet the uncompromising idealism and absolute spirituality of the book demanded and gained attention. A. Bronson Alcott was the first to give Mrs. Eddy a comforting assurance for the future of her book, and Wendell Phillips said: "Had I young blood in my veins, I would help that woman."

At the outset, it was Mrs. Eddy's expectation, and for years her hope, that the existing churches would welcome her interpretation of Christianity, proved as it was by the restoration of Christian healing. A considerable number of ministers did accept her offer to this profession of free admission to her classes, and some of them invited her to speak in their pulpits. In course of time, however, it became evident to Mrs. Eddy that a distinct church was necessary to preserve Christian Science intact, for the benefit of that and future generations. Accordingly, the First Church of Christ, Scientist, was organized at Boston in 1879. Four years later another step was taken when Mrs. Eddy founded the first of the Christian Science periodicals, *The Christian Science Journal*. During the ensuing years, the teaching of eight classes of students annually, weekly preaching to eager congregations, editing the monthly organ of her church, and heading all the activities of the expanding Christian Science movement, made her life one of the most eventful in the annals of men. And though Mrs. Eddy, in her later years, trained others to relieve her of some detail and duty and to become the directors of Christian Science affairs, she continued to be the active leader of the movement she instituted until her decease (at Newton, Mass., 3 Dec. 1910). It was characteristic of Mrs. Eddy that she devised the bulk and residue of her estate to be used "for the purpose of more effectually promoting and extending the religion of Christian Science as taught by me." Her principal writings are 'Science and Health with Key to the Scriptures' (1875); 'People's Idea of God' (1886); 'Christian Healing' (1886); 'Retrospection and Introspection' (1891); 'Unity of Good' (1891); 'Rudimental Divine Science' (1891); 'No and Yes' (1891); 'Church Manual' (1895); 'Miscellaneous Writings' (1896); 'Christ and Christmas' (1897); 'Christian Science versus Pantheism'

(1898); 'Pulpit and Press' (1898); 'Messages to The Mother Church' (1900, 1901, 1902); 'Poems' (1910); 'The First Church of Christ, Scientist,' and 'Miscellany' (1913). Consult 'Life' by Wilbur (4th ed., Boston 1913).

CLIFFORD P. SMITH.

EDDY, Thomas, American philanthropist: b. Philadelphia, Pa., 5 Sept. 1758; d. New York, 16 Sept. 1827. He entered the insurance business in 1790, in which he made a large fortune. With Philip Schuyler and Ambrose Spencer he presented a bill for establishing a penitentiary system in 1796, which was passed. He had charge of erecting the first building and for four years was its director. In 1793 he was appointed by the Society of Friends to visit the Indians in New York State; was one of the governors of the New York Hospital; and in 1815 one of the founders of the Bloomingdale Insane Asylum. He was also one of the originators of the New York Savings Bank and the New York Bible Society, and a conspicuous promoter of the Erie Canal. He received the title of the "American Howard" for these labors, and in 1801 published 'State Prison of New York.'

EDDY CURRENTS. See FOUCAULT CURRENTS.

EDDYSTONE LIGHTHOUSE. The frequent shipwrecks on Eddystone rocks off the coast of Cornwall, England, led to the erection of a lighthouse on them by Henry Winstanley in 1696–1700. It was a wooden polygon, 100 feet high, with a stone base; but the great storm of 20 Nov. 1703, completely washed it away, with the architect. Another lighthouse was built in 1706–09, also of wood, with a stone base, and 92 feet high, by Mr. Rudyerd, a silkmercer. This erection was burned in 1755. The next, noted for its strength and the engineering skill displayed in it, was constructed by Smeaton in 1757–59, on the model, it is said, of the trunk of the oak tree. It was built of blocks, generally one to two tons weight, of Portland oölite, encased in granite. The granite was dovetailed into the solid rock, and each block into its neighbor's. The tower, 85 feet high, had a diameter of 26¾ feet at the base and 15 feet at the top. The light, 72 feet above the water, was visible at a distance of 13 miles. As the rock on which this tower was built became undermined and greatly weakened by the action of the waves, the foundation of another was laid on a different part of the reef in 1879. The new lighthouse, completed in 1882 by Sir James N. Douglass, is, like its predecessor, ingeniously dovetailed throughout. Its dioptric apparatus gives, at an elevation of 133 feet, a light equal to 159,600 candles, and visible in clear weather to a distance of 17½ miles. See LIGHTHOUSE.

EDELFELT, ā'dĕl-fĕlt, **Albert Gustav Aristid,** Finnish painter: b. Helsingfors, Finland, 21 July 1854; d. 1905. He began his artistic studies at Antwerp and afterward became a pupil of Gérôme, in Paris, where he developed a high skill in draughtsmanship, in the department of genre and portrait painting. He gained a second medal in the Paris Salon of 1882, and a medal of honor in the Paris Exposition of 1889. Two of his pictures have been purchased by the French nation for the Luxembourg. Of his paintings the best are 'The Laundry' (1893); 'Christ and the Magdalen' and 'The Women in the Churchyard' (Helsingfors Museum); and 'Divine Service on the Seashore' (1882). He became commander of the Legion of Honor (1901).

EDELWEISS, ĕd'ĕl-wīs, Ger. ā'dĕl-vīs, ("Noble-white"; *Gnaphalium* or *Leontopodium alpinum*), a perenial plant of the order *Compositæ*, growing at great altitudes, in the Alps, the Pyrenees and also in parts of Austria and Siberia. Its flower is white and somewhat star-shaped, the heads surrounded with a characteristic woolly involucre, and its leaves also having the same woolly character. It is comparatively scarce; generally grows in inaccessible positions; is eagerly sought by Alpine tourists, and has become so rare in some of the Swiss cantons that it is protected by law. The supposed difficulty of gathering it is the groundwork of various legends and poems; as the emblem of purity, it is given by the Tyrolese youth to his affianced bride. It is not difficult to cultivate and is found in American and European gardens, but is apt to lose its distinctive woolly character under cultivation.

EDEMA. See DROPSY.

EDEN, SIR **Robert,** last proprietary governor of Maryland: b. Winderstone Hall, Durham, England; d. Annapolis, Md., 2 Sept. 1784. As captain in the Coldstream Guards he served in the Seven Years' War. He was appointed governor of Maryland in 1768, where he remained until 1776, when that State committed itself to the principles of the Revolution, and virtually declared the proprietary governorship at an end. He left in an English warship, but returned a few months before his death. Consult Steiner, 'Life and Administration of Sir Robert Eden' (in the 'Johns Hopkins University Studies in Historical and Political Science,' 16th series, VII–IX, Baltimore 1898).

EDEN, William, 1st Lord AUCKLAND: b. Durham, April 1744; d. there, 28 May 1814. He was educated at Eton and at Oxford, where he received his M.A. in 1768. He studied law and published in 1772 'Principles of Penal Law.' In the same year he was chosen Undersecretary of State. In 1774 he entered the House of Commons and was again chosen in 1778, when he was one of the five commissioners to America. He published a report on his return in the form of 'Four Letters to the Earl of Carlisle.' In 1780 he accompanied Lord Carlisle as Chief Secretary to Ireland. In this capacity he was instrumental in establishing the National Bank of Ireland. In 1783 he became Vice-Treasurer of Ireland and a member of the privy council. He was a staunch supporter of Pitt, resigning with him in December 1783 and returning with Pitt's ministry in the following year. Eden was made Lord of the Committee of Council on trade and plantations, and was sent to France to negotiate the commercial treaty, which was finally consummated in 1786–87. He served as special Ambassador to Madrid in 1788; to the United States and to Holland in the succeeding years. In the latter country he was especially active during the years 1790–93 as Ambassador extraordinary. In the last named year he retired and was created a peer of Great Britain as Lord Auckland of West

Auckland, Durham. His support of Pitt continued, and in 1798, he returned to office in the capacity of joint Postmaster-General. His final resignation came in 1801, when the Pitt ministry collapsed under the disapproval of the king in regard to their Irish policy. The love of Pitt for Auckland's eldest daughter who later married the Earl of Buckinghamshire strained the relations between Pitt and Auckland, and resulted in the latter's refusal to join Pitt's second ministry. In 1796 he was chosen to be chancellor of Marischal College. Besides the publications already mentioned, he wrote 'History of New Holland' (1787), and 'Remarks on the Apparent Circumstances of the War.' His 'Journals and Correspondence' were edited by his son, Robert John, bishop of Bath and Wells (4 vols., 1860–62).

EDEN, the garden of paradise. It would be difficult in the whole history of opinion, to find any subject which has so invited and at the same time so completely baffled conjecture, as the Garden of Eden. The three continents of the Old World have been subjected to the most rigorous search; but no locality which in the slightest degree corresponded to the description of the first abode of the human race has been left unexamined. Philo Judæus (flourished about 20) first broached the allegorical theory of interpretation, teaching that paradise shadowed forth the governing faculty of the soul, and that the tree of life represented religion, the true means of immortality. Origen, adopting a somewhat similar view, regarded Eden as heaven, the trees as angels, and the rivers as wisdom; and Ambrosius considered the terrestrial paradise and the third heaven, mentioned by Saint Paul (2 Cor. xii, 2–4), as identical. Luther taught that Eden was guarded by angels from discovery and consequent profanation until the Deluge, when all traces were destroyed. Swedenborg, who regarded the first 11 chapters of Genesis as constituting a divine allegory, taught that Eden represented the state of innocence in which man was originally created and from which he degenerated in consequence of the Fall. The account given in Genesis of the situation of Eden is not such as to enable us to identify it with any existing locality. It is said to have had a garden in the eastern part of it, and we are told that a river went out of Eden to water this garden, and from thence it was parted into four heads, which were called respectively Pison, Gihon, Hiddekel and Euphrates (Phrat). The Pison is said to compass the whole land of Havilah; the Gihon that of Ethiopia (Cush); and the Hiddekel to go toward the east of Assyria. Of the rivers mentioned the Phrat of the original seems to have been correctly identified with the Euphrates, and the name Hiddekel appears elsewhere in Scripture (Dan. x, 4) to be applied to the Tigris; but it is impossible to say what rivers or places were meant by the names Pison, Gihon, Havilah and Cush.

EDEN, the principal river in the county of Cumberland, England, rising in the hills of Westmoreland, near the northwest boundary of Yorkshire; flows northwest, passing Appleby and Carlisle, and empties into the Solway Firth. Total course, about 65 miles.

EDEN OF AMERICA, a fanciful name bestowed on the island of Aquidneck, on which is situated the city of Newport, R. I., on account of its great fertility.

EDENHALL, the ancient seat of the Musgraves in Cumberland, four miles northeast of Penrith, England. Here is still preserved the famous "Luck of Edenhall," an old painted glass goblet, said to have been snatched from the fairies, on the safety of which the welfare of the house depends. It is supposed to have been a chalice, and its leathern case bears a sacred monogram. Uhland's well-known ballad, 'The Luck of Edenhall,' and Longfellow's translation of it has carried its fame beyond the British islands.

EDENTATA, ē-dĕn-tā'tą one of the smaller orders of mammals, most of which are found in South America. It includes the South America sloths, ant-eaters and armadillos, and two Old World groups, all of which are characterized by an absence of front teeth, and in a few instances by completely toothless jaws, whence the generic name. Where teeth are present they are without enamel, and lack distinct roots, are all alike and generally are not preceded by a set of milk teeth. These animals are ranked comparatively low in the scale of mammals, not only on account of their deficiency in teeth, but also because their brains are relatively small and lack the convolution characteristic of the more highly developed orders. With two exceptions, the armadillos and pangolins, the Edentata are clothed with coarse hair, and they never are completely hairless. The armadillos are peculiar among mammals, in that their bodies are covered with an armor of bony plate; and in the pangolins the entire body is protected by a coat of overlapping, horny scales. The typical edentates are the sloths (*Brodypodidæ*), the ant-eaters (*Myrmecophagidæ*) and the armadillos (*Dasypodidæ*), all of which are American; the two groups in the order, native to Africa and Asia, are the pangolins (*Squamata*) and the aard-varks (*Tubulidentata*), although Lydekker questions the correctness of placing the last two among the edentates, preferring to consider the present and extinct forms as an entirely American order. The sloths live on vegetable food exclusively, the other group chiefly on insects or animal matter softened by decay.

Fossil Edentates.— Of the large and numerous edentate fauna which lived in South American during the Tertiary and Quaternary periods, some (*Mylodon, Megaionyx, Glyptodon*) spread to North America during the Pliocene and Pleistocene epochs; the armadillo is still found as far north as the Mexican border of the United States. Their earliest ancestors were, perhaps, North American, but their development was exclusively in the southern continent during most of the Tertiary period. The earlier stages in their evolution were less divergent from the normal mammals than the present edentates, and were of small or moderate size; later on they became of huge size and very highly specialized. The most remarkable among them were the *Megatheriidæ*, ground-sloths, distantly related to the modern ant-eaters and true sloths, but terrestrial animals, very heavily proportioned, with massive hind quarters and tail, and immense digging claws;

and the *Glyptodonts*, related to armadillos but much larger, with massive unjointed carapace like that of a tortoise and with hoofs instead of claws. Besides these were numerous true armadillos, both large and small, some ancestral to the modern species, others of extinct races. No fossil ant-eaters have yet been discovered, and fossil tree-sloths are almost equally unknown; but the fossil beds of South America have been so imperfectly explored that this fact is not surprising. See AARD-VARK; ANT-EATER; ARMADILLO; GANODONTA; GLYPTODON; MANIS; MEGATHERIUM; MYLODON; SLOTH.

EDENTON, N. C., town and county-seat of Chowan County; on the Albemarle Sound near the mouth of the Chowan River; on two branches of the Norfolk and Southern Railroad; about 90 miles north of Beaufort and 115 miles northeast of Raleigh. Four steamship lines enter Edenton, thus making it a good shipping point for the trade of the northeast part of the State. The shallow waters of the Albemarle Sound are a hindrance to more extensive shipping. The name given to the town when founded in 1712 was Queen Anne's Creek, but this was changed to Edenton in honor of a governor of the colony, Charles Eden. In less than one year after the "Boston Tea Party," on 24 Oct. 1774, 52 housewives of Edenton resolved not to assist in supporting England by paying a tax on tea; and they formed themselves into an organization, none of whose members should conform "to that pernicious custom of drinking tea" and "would not promote ye weare of any manufacture from England." In addition to being first among those who held Revolutionary tea parties, they seem to have been pioneers in America in the formation of organizations for women. Its industrial establishments include cotton mills, peanut factories and lumber mills. The herring and shad fisheries are also important. A fish hatchery is maintained here by the government. The municipality owns the waterworks and lighting plants. Pop. 3,000.

EDER, ā'dĕr, **Joseph Maria,** Austrian chemist: b. Krems on the Danube, 16 March 1855. He taught photo-chemistry at the Technical School, Vienna, and in 1882 was made professor of chemistry at the Industrial School in that city. He has made great contributions to the development of the art of photography, particularly with reference to the use of chloride or bromide of silver. He also invented a photometer for measuring the invisible ultra violet rays by the oxalate of mercury, and the now extensively-used aristo papers (chloro-gelatin papers). Among his works are 'Photographie aux sels de chrome'; 'Etudes sur l'action de la lumière colorée' (1879); 'Manuel de photographie' (1882); 'Die Momentphotographie in ihrer Anwendung auf Kunst und Wissenschaft' (2d ed., 1886); 'Arleitung zur Herstellung von Momentphotographien' (1887); 'Photographie mit Bromsilbergelatine' (1890); 'System der Sensitometrie photographischer Trockenplatten' (1899–1902); 'Beitrage zur Photochemie und Spektralanalyse,' with Valenta (1903); 'Atlas typiert Spektien' (1911). He was from 1887 to 1911 editor of the *Jahrbuch für Photographie und Reproduktionstechnik*.

EDERSHEIM, ād'ers-hīm, **Alfred,** English biblical scholar: b. Vienna, 1825; d. 1889. He was of Jewish extraction and received his education at the university of his native city. He became a tutor in Pest and was there converted to Christianity by John Duncan. He studied theology at Berlin and Edinburgh; was ordained to the Presbyterian ministry in 1846 and soon afterward appointed to the Free Church, Aberdeen, where he continued until 1858. Years later (1884–85) he was select preacher to the University of Oxford and Grinfield lecturer on the Septuagint in 1886–90. He published 'Bible History' (7 vols., 1876–87); 'Jewish Social Life in the Days of Christ' (1876); 'The Exodus and the Wanderings in the Wilderness' (1876), and 'The Life and Times of Jesus the Messiah' (1883), his principal work.

EDES, Robert Thaxter, American physician: b. Eastport, Maine, 23 Sept. 1838. He was graduated at Harvard 1858 and at the Harvard Medical School 1861; served as surgeon in the United States navy 1861–65; was professor of materia medica 1870–84, and professor of clinical medicine 1884–86 at the Harvard Medical School. He was physician at the Boston City Hospital 1872–86 and at the Garfield Memorial Hospital, Washington, 1889–91, and resident physician at the Adams Asylum 1891–97. Among his works are 'Nature and Time in the Cure of Diseases' (1868); 'Physiology and Pathology of the Sympathetic or Ganglionic Nervous System' (1869); 'Therapeutic Handbook of the United States Pharmacopœia' (1883); 'Therapeutics and Materia Medica' (1887), and many contributions to medical publications.

EDESON, Robert, American actor: b. New Orleans, La., 1868. He was educated in the public schools of Brooklyn and made his first appearance in 'Fascination' at the Park Theatre, New York, in 1887. Later he appeared in 'A Night Off'; 'The Dark Secret'; 'Incog.,' and 'Under the Red Robe' in 1906. He was leading man in 'The Climbers' and starred in 'Soldiers of Fortune' (1902–04); 'Ransom's Folly'; 'Strongheart' (1905–07); 'Classmates' (1907); 'The Call of the North' (1908); 'The Noble Spaniard' (1909); 'Fine Feathers' (1913). He also played the rôle of Ma-Wo-Cha-Sa in his own play, 'Where the Trail Divides' (1910).

EDESSA, the name of two ancient cities. (1) The ancient capital of Macedonia and the burial place of its kings, now Vodhena. It is probably the same with the still more ancient Ægæ. (2) An important city in the north of Mesopotamia, which, subsequent to the establishment of Christianity, became celebrated for its theological schools. During the centuries which were affected by the Christianizing of Rome, Edessa became the centre of learning of Syria. (See SYRIA). The modern city of Urfah or Orfa stands on the site once occupied by Edessa. In 1098, in the first crusade, Edessa came into the hands of Baldwin I, but ultimately became part of the Turkish empire in 1637. It was one of the greatest four cities of Syria, the other three being Antioch, Damascus and Nisibis. The modern city has a population of about 30,000, mostly Mohammedans. The Mohammedans consider it a sacred city, and maintain that Abraham at one time lived there.

Consult the article, "Edessa in Osroene," by Meyer (in Pauly-Wissowa, 'Real-Encyclopädie der klassischen Altertumswissenschaft,' Stuttgart, 1905).

EDFU, ĕd'foo, Egypt, town situated on the Nile, 54 miles southeast of Thebes. It contains the remains of two temples, the larger of which is the best preserved monument of its kind in Egypt. It was founded by Ptolemy III Philopator more than two centuries before Christ and added to by his successors down to Ptolemy XIII Dionysus, a period of 170 years. The general plan of the temple resembles that of Dendera. Its length is 451 feet, the breadth of its façade is 250 feet. Its entrance is by a gateway 50 feet high, between two immense truncated pylons, 37 feet wide at the base and 115 feet high, the whole surface covered with sculptures and inscriptions in low relief. This splendid façade is visible from a great distance and is one of the most commanding sights in the Nile valley. Passing through this entrance, a court is reached 161 feet long and 140 feet wide, enclosed by a splendid colonnade of 32 columns of every variety of capital, and surrounded by walls between which and the pillars there is a stone roof, forming a covered portico. From this court opens a hypostyle hall of 18 columns, joined by an intercolumnal screen, through which access is obtained to an inner hall of 12 columns, leading to the sanctuary, where a great monolith of gray granite was evidently intended to encage the hawk, the sacred emblem of Hor-Hud, the local Horus, to whom the temple was dedicated.

The sanctuary and surrounding chambers, together with the outer and inner halls, are separated by an open corridor from the outer wall of the temple, and both sides of this passage are covered with elaborate reliefs and numerous inscriptions, which present a sort of encyclopædia of ancient Egyptian geography, ritual and ecclesiastical topography, with calendars of feasts, lists of divinities in the various names and cities, and even a species of church directory, including the names of singers and other temple officials. The smaller temple, erected by Ptolemy Physcon and Lathyrus, consists of only two chambers. Previous to 1860, both court and temple were inlaid with rubbish, fallen stone, etc. Nomad Arabs built lean-to sheds against the walls until Mariette, with the consent of the Khedive had all these disfigurements removed and established a semblance of order. Consult Mariette, 'Monuments of Upper Egypt' (London 1877); Breasted, 'Ancient Records of Egypt' (Chicago 1907). The manufactures of Edfu at present are blue cotton cloths, and earthenware similar to the ancient Egyptian pottery. Pop. 2,500.

EDGAR ("THE PEACEABLE"), one of the most distinguished of the Saxon kings of England, was the son of King Edmund. He succeeded to the throne in 958, and managed the civil and military affairs of his kingdom with great vigor and success. He maintained a body of troops to control the mutinous Northumbrians, and repel the incursions of the Scots, and fitted out a powerful navy to protect his subjects from the Danes. During the reign of Edgar, wolves were nearly extirpated from the southern parts of the island, by exchanging a tribute from Wales for payment in the heads of these animals. He married Elfri, daughter of the Earl of Devonshire, in 965. It was during his reign that Dunstan (q.v.) was primate of England. He died in 975, and was succeeded by his son, Edward the Martyr.

EDGAR, SIR James David, Canadian statesman and author: b. Hatley, province of Quebec, 10 Aug. 1841; d. 1899. He was admitted to the bar of Ontario 1864. In 1872 he was elected to the Dominion Parliament; served in 1874 on an unsuccessful mission to British Columbia on the dispute between that province and the Dominion as to the terms of construction of the transcontinental railway; and was elected speaker of the Commons in 1896. He was the author of 'The White Stone Canoe' (1887); 'This Canada of Ours and Other Poems' (1893), etc.

EDGAR ATHELING, Anglo-Saxon prince: b. Hungary about 1057; d. toward the end of the 11th century. He was a grandson of Edmund Ironside, and his life may be epitomized as a series of abortive attempts. Selected by Edward the Confessor as his prospective heir, he was kept out of the throne by William the Conqueror (1066); having twice engaged in the northern revolts against the Normans, he was twice compelled to take refuge in Scotland, with Malcolm Canmore, who married Edgar's sister, Margaret; then, embracing the cause of Robert, Duke of Normandy, against William Rufus, he was driven away (1091) from the duchy to Scotland; then he embarked (1099) in a bootless crusading expedition to the East; and finally was taken prisoner at Tenchebrai (1106) fighting for Duke Robert against his brother Henry I. Almost the only successful achievement of his life seems to have been that of reseating his nephew Edgar on the throne of Scotland (1097), which had been usurped by Donald Bane. His last days were spent in obscurity; the date of his death is not precisely known. Consult Freeman, 'History of the Norman Conquest' (Vols. III–V, Oxford 1873).

EDGARTOWN, Mass., town, county-seat and port of entry of Duke's County; situated on the eastern shore of the Island of Martha's Vineyard, 27 miles southeast of New Bedford. At present it is a summer resort, but it was once a whaling station of importance. The town was settled in 1642 and was incorporated in 1671. Its harbor is small but well-sheltered. It contains a Carnegie library. Pop. 1,191. Consult Banks, 'History of Martha's Vineyard' (Boston).

EDGCUMBE, ĕj'cŭm, **SIR Edward Robert Pearce,** English traveler: b. 13 March 1851. He was educated at Cambridge, was mayor of Dorchester 1891, and sheriff of Cornwall 1896. He has published 'Zephyrus, or Travels in Brazil and on the river Plata' (1887); 'Bastiat's Popular Fallacies' (4th ed., 1893); 'Popular Fallacies Regarding Bimetallism' (1896); 'The Parentage and Kinsfolk of Sir Joshua Reynolds' (1901), etc.

EDGE, Walter Evans, American public official: b. Philadelphia, Pa., 20 Nov. 1873. He was educated in the public schools and began life as a printer's "devil" on the *Atlantic Review* of Atlantic City, N. J. Later he established a national and international advertising agency, acquired the proprietorship of the At-

lantic City *Daily Press* and the *Evening Union* of that city. He also became identified with banking and other lines of business. In 1897–99 he was journal clerk of the Senate of New Jersey and from 1901 to 1904 served as secretary of that body. In 1904 he was a Republican presidential elector and in 1908 was alternate delegate-at-large to the Republican National Convention at Chicago. In 1909 he became a member of the Assembly of New Jersey and served two terms in the Senate, from 1910 to 1916, becoming Republican leader in 1912 and president of the Senate in 1916. He was chairman of the economy and efficiency commission and a leader in securing passage of the Workmen's Compensation Act and the Central Purchasing Bureau Act. During the Spanish-American War, Mr. Edge served as second lieutenant in the 4th New Jersey Volunteer Infantry and afterwards was made captain in the Third Regiment of the New Jersey National Guard. For the term 1917–20 Mr. Edge was governor of New Jersey.

EDGEHILL, ĕj'hĭl, England, an eminence in Warwickshire, 12 miles south of Warwick. On its northern slope was fought the first battle of the civil war, Sunday, 23 Oct. 1624, between the Royalists under Charles I and the forces of the Parliament under the Earl of Essex. It was an indecisive engagement.

EDGEWORTH, ĕj'wėrth, Maria, English novelist: b. Hare Hatch, near Reading, Berkshire, 1 Jan. 1767; d. Edgeworthtown, Ireland, 21 May 1849. In 1782 her father, Richard Lovell Edgeworth, succeeded to the family estate of Edgeworthtown, in the county of Longford, Ireland, and thither he proceeded and took up his abode. In 1802 she established her position as an author by her 'Castle Rackrent,' a novel of Irish life, in which the manners and customs of a by-gone generation are most graphically and humorously described. A 'Treatise on Irish Bulls' appeared in 1803; 'Ennui' (1809); 'The Absentee' (1812); 'Ormond' (1817). About 1803–04 she began to write stories with pointed morals, both for children and adults. Among these may be mentioned 'Moral Tales'; 'Popular Tales'; 'Tales of Fashionable Life'; The Parents' Assistant,' a collection of tales for children, and the well-known series of 'Early Lessons'; 'Harry and Lucy'; 'Frank'; and 'Rosamond.' Belonging to the class of regular novels are 'Belinda' (1804); 'Leonora' (1806); 'Patronage' and 'Harrington.' Miss Edgeworth's lively style and vivid imagination made her extremely popular in her day. In her pictures of Irish and English life she was the precursor of the genre literature of the succeeding generation. But her strong tendency to moralize has led to her eclipse in popular favor. It is on the excellence of her vivid representation of the life of her generation that her place in literature is justly based. (See CASTLE RACKRENT). Consult Ritchie, Thackeray Anne, 'Book of Sibyls' (1883); Zimmern, 'Life of Maria Edgeworth' (1883); Howells, W. D., 'Heroines of Fiction' (New York 1901); Hill, 'Maria Edgeworth and her Circle' (New York 1910).

EDGREN, Anne Charlotte Leffler, ăn shä-lŏt'tĕ lĕl-lĕr ĕd'grĕn, Swedish novelist and dramatist: b. Stockholm, 1 Oct. 1849; d. Naples, 24 Oct. 1892. A volume of short tales, 'By Chance,' and the dramas, 'The Actress'; 'The Curate,' were a great success anonymously; and she then put her own name to three successive volumes of short stories called 'From Life,' followed by 'A Summer Story'; 'Woman and Erotism' and many others. 'Ideal Women'; 'The Struggle for Happiness'; and 'A Rescuing Angel' (the most successful of her plays), are notable among her later dramas. Consult Key, Ellen, 'Life of Edgren' (1893).

EDHEM PASHA, pash-ä' or päsh'ą, Turkish soldier and statesman: b. Chios, 1813, of Greek parentage; d. 1893. He studied in Paris, and on returning to Turkey was attached to the staff of the army with the rank of captain, rapidly attained that of colonel, and was appointed a member of the Council of Mines at the time of its formation. Having been appointed aide-de-camp to the Sultan in 1849, he soon was placed at the head of His Majesty's household troops. In 1856 he resigned the functions which he had fulfilled at the palace, and was appointed a member of the council of the Tanzimat, and afterward Minister of Foreign Affairs, with the rank of muchir. Subsequently he played an important part in the affairs of his country, where he was nominated president of the council of state. He was also for some time Ambassador at Berlin. At the conference of Constantinople (1876–77) he acted as the second Turkish Plenipotentiary, and was appointed to succeed Midhat Pasha as grand vizier, 5 Feb. 1877. From 1879 to 1883 he was Ambassador at Vienna.

EDHEM PASHA, Turkish soldier: b. 1851; d. 1909. In 1877 he held the rank of colonel in the Turkish army and rose rapidly during the war with Russia. He was appointed governor-general of the Vilayet of Kossowo, and was later made adjutant-general and field marshal. In the war with Greece (1896–97) he had the chief command of the Turkish army. In three weeks he collected an army of 55,000 men, met and defeated the Greeks at Maluna Pass, invaded Thessaly and occupied Larissa. In this campaign he displayed great skill as a commander and was no less successful in organizing the sanitary and hospital services of his armies.

EDICT, a public proclamation of laws made by a ruler or superior magistrate. In ancient Rome, the higher officers of state, who were elected annually, publicly declared, at their entrance upon office, the principles by which they should conduct their administration. This was done particularly by the ædiles, who superintended buildings and markets, and by the prætors, as supreme judges. These annual proclamations, by which the deficiencies of the general statutes were supplied, and the laws were adapted to the peculiar wants of the period, gradually acquired a certain permanency, as each officer retained, unaltered, most of the regulations of his predecessor (*edictum tralatitium*); and they became, in fact, the source of that branch of Roman law which, being founded on the official authority of the authors, was called *jus honorarium*, and was opposed to the strictly formal law, *jus civile*. However, according to Roman jurists these usually indirect forms of legislation had their object in rendering the civil law more expedient to the public welfare, and always received the seal of the people's approval. Edicts were sometimes made for some

special occasion, in which case they were called *edicta repentina*. It was against the abuse of this kind of edicts that the Lex Cornelia in 67 B.C. was directed. Those which were applicable in all cases during the tenure of office of the magistrate who issued them were called *edicta perpetua*. The name of *edictum perpetuum* was also given to a collection and arrangement of the clauses which the prætors were accustomed to put into their annual edicts, made under the Emperor Hadrian by Salvius Julianus about 131 A.D. What the exact nature of the work thus done by Julianus was is not known, but the edict prepared by him, and sanctioned by Imperial authority, had unquestionably a special force, and it is likely that it restricted in future the right enjoyed by magistrates of issuing edicts, to such cases as were not provided for in the edict of Julianus. Only a few fragments of the ancient Roman edicts have been preserved by Wieling in 'Fragmenta Edicti Perpetui' (Frankfort 1733). See CIVIL LAW.

EDICT OF NANTES, a decree of Henry IV, king of France, published 13 April 1598, by which he conceded to the Huguenots, or Protestants of that kingdom, toleration for their religious beliefs, teachings and practices; freedom of public worship and liberty to erect churches, except at Paris and the royal residences, and to maintain. the four Protestant universities of Saumur, Montauban, Montpellier and Sedan; admission as members to the parliament of Paris and the right to special chambers in the parliaments of Grenoble and Bordeaux; further, the right to hold provincial and national synods. In 1620 the Huguenots in their political congress at La Rochelle confiscated all the property of the Roman Catholic churches and constituted throughout France a military and civil organization for Huguenot ends.

Before the formal revocation of the Edict of Nantes the liberties of the Protestants were largely restricted by partial acts of revocation, which precluded them from office in the government, from membership in trade corporations, etc., and from marriage with Roman Catholics. The edict was formally revoked by a decree of Louis XIV, 18 Oct. 1685. It ordered the churches of the Huguenots to be destroyed, forbade the holding of religious meetings and of synods by Protestants on penalty of confiscation of goods; banished all Protestant ministers; ordered the children of Protestants to be baptized and brought up as Roman Catholics.

EDINBURGH, ed'in-bŭr-ŭ (Edinboro), the metropolis of Scotland and one of the finest cities in the British Isles, is built on ridges and hollows that run east and west. It is picturesquely situated on the southern shore of the Firth of Forth, 47 miles east of Glasgow, and 400 north of London. From the Firth the ground slopes somewhat unevenly upward to the top of the Castle Rock, 438 feet above sea level. The Central Ridge, which constituted the site of the old town, is terminated on the west by the Castle Rock, and by Holyrood Palace on the east. Arthur Sea (822 feet high) overlooks the whole of the eastern and southern part of the city, and between it and the Palace are the elevations known as Salisbury Crags. The new town lies between the old town and the sea. The houses, streets, squares and gardens are all handsome, built of beautifully dressed freestone found in the neighborhood of the city. The principal streets of the new town are Princes street, George street and Queen street, running parallel with each other.

Geological Formation.— The geological formation upon which Edinburgh is built is of a very interesting character. The rocks which underlie the town belong to the lowest divisions of the carboniferous system, but here and there in the neighborhood, such as in the rocks of the Pentlands, Blackford Hill, and a portion of Arthur Seat, there are several veins of igneous rock. The district has always been an interesting one for the geologist, and several writers of standing have dealt with the subject, among whom may be named — Hutton, Playfair, Forbes, Millar, McLaren and Geikie.

Principal Buildings, Galleries, Museums, etc.—In Princes street there are some notable buildings, and on the Mound connecting it with the old town is the National Gallery, while near at hand to the east is the Scott Monument. The old town has suffered very much at the hands of the improver, but there are still "closes," "lands," and "wynds," which are interesting to the visitor. From the Castle to Holyrood House there is one continuous street, known at different parts as the Lawnmarket, the High street, and Canongate. It is upward of a mile in length, and is frequently termed "The Royal Mile." Among the notable buildings in and around this "Royal Mile" are the Tolbooth Church, the meeting place of the General Assembly of the Church of Scotland; the United Free Church Assembly Hall, Saint Giles' Cathedral, Parliament House, the Advocates' Library, the Signet Library, and the municipal buildings. The Tron Church is at the junction of South Bridge with the High street. Continuing down the Canongate on the left is the house of John Knox, the great Reformer, while on the right further down is Moray House, once occupied by the Regent Murray, in the garden of which stood, till quite recently, a tree said to have been planted by Queen Mary. In the garden is still existing a summer-house where it is averred the Treaty of Union was signed. There are other interesting buildings in the Canongate, such as the Tolbooth and Queensberry House. To the north of the "Royal Mile" there are such buildings as the Bank of Scotland in Bank street, and the Scotsman Buildings in North Bridge. From the head of the Canongate a particularly good view can be had of the Calton Hill, with its Nelson Monument and the never-to-be-finished National Monument. To the south the public buildings in George IV Bridge are the County Buildings, the Sheriff Court-house, and the Public Library (the latter erected in 1887 at a cost of £50,000, given by Andrew Carnegie; total stock now is 165,000 volumes); while in Chambers street there is the Royal Museum of Science and Art, the Heriot Watt College, and the University (q.v.). Near at hand are the Students' Union, M'Ewan Hall, Heriot's Hospital, and the Royal Infirmary, all of which are distinctive buildings. The Castle contains accommodation for 2,000 soldiers, and the Armory has places for 30,000 stands of arms. The regalia of Scotland is kept in an apartment by itself. Another attraction to visitors, besides this, is Queen Mary's

EDINBURGH

1 The Castle and Museum

2 The Old Town, from Princess Street

room, which is visited annually by large numbers. Holyrood Palace and Abbey stand at the east termination of the "Royal Mile," and the former is only now used on the occasion of the visit of the royal commissioner to the general assembly. It was begun by James IV near the end of the 15th century, suffered destruction in Hertford's invasion in 1544, with the exception of portions built by James V in 1528; was destroyed by fire during the Cromwellian occupation in 1650; and the greater portion of the present building dates only from the time of Charles Second. The apartments occupied by Queen Mary are in the northwest corner of the building, and in very nearly the same state as that in which they were left by that unfortunate princess. The Abbey is supposed to have been founded by King David I in 1128; it suffered at the hands of the English in 1544 and from the iconoclastic zeal of the reformers about 1558; in 1688 the chapel, which had again been set apart for worship in accordance with Roman rites, was completely destroyed by a Protestant mob. Other interesting buildings are the Royal Museum of Science and Art, the National Portrait Gallery and Antiquarian Museum in Queen street; Fettes College, Daniel Stewart's College, and the Cathedral of Saint Mary (Episcopal). Saint George's Church in Charlotte square is a notable modern ecclesiastical building. Along with the University the more prominent educational institutions are the New College, the School of Medicine, Heriot-Watt College, Fettes College, the High School, the Academy, Daniel Stewart's College, and George Watson's College. The southern part of the city is modern, but extends now to the foot of the Pentland Hills, including the Braid hills, the golf course of which is one of the best inland courses in Scotland.

Manufactures.— The principal manufactures in Edinburgh are printing, type-founding, coach building, ale brewing, and cabinet-making. It is the seat of the principal government departments for Scotland, and the headquarters of the book trade.

Government.—The town council consists of lord provost, magistrates known as bailies, treasurer, a dean of guild, and 41 ordinary councillors. Edinburgh was a royal burgh as early as the time of David the First, its designation at that time being Edwinesburgh. The outlying suburb of Portobello on the northeast was added in 1896.

Railways.— The two principal railways connecting Edinburgh with other parts of the country are the Caledonian and North British railways. There are 25 miles of cable tramways throughout the city. The system has been municipally owned since 1893; and in 1910 a beginning was made with an overhead electric system in one of the suburbs. To this system there was at one time a rooted aversion, due to a desire to preserve the amenity of Princes street; but on the expiry of the present operating company's lease in 1919, it is certain that the whole system will be electrified.

Electricity.— The city is beautifully lit by an electric installation, which has been one of the most successful in the Kingdom. Not only is the public supplied on an extensive scale, but all the private houses of the modern parts of the town have electricity as the domestic light.

Parks.— Edinburgh is particularly well off with open spaces. The King's Park, including Arthur Seat, Salisbury Crags, etc., is one of the most handsome in the Kingdom, although very little is done to adorn it either by the government or the local authority. The Braid Hills and Blackford Hill, on the latter of which is the Royal Observatory, are picturesque resorts in the summer time, while in the very centre of the town there are the Calton Hill, East and West meadows and Bruntsfield links. Invorleith Park on the north, and Saughton Park on the western outskirts, are recent additions — the latter a noteworthy one. A fine zoölogical garden has been opened on Constorphine Hill, west of the city.

Climate.— Robert Louis Stevenson, who was constitutionally ill adapted for the bracing and somewhat rigorous climate of his native city, has said that Edinburgh "pays cruelly for her high seat in one of the vilest climates under heaven," and has described the east winds that prevail in spring as making of the city a "meteorological purgatory." Despite these strictures the city is a healthy one, with an annual mean temperature of 47° F., and a rainfall of 27 inches.

Churches.— Edinburgh is noted for its churches. It is distinctively a Presbyterian city, there being in connection with the Church of Scotland some 46 churches, and with the United Free Church, about 66.

Population.— The population in 1901 was 316,479; in 1911, 320,318. The ratable value of the city in 1915–16 was $16,633,100.

Charitable Institutions and Libraries.— Among benevolent institutions are the Royal Infirmary; Donaldson's Hospital; Deaf and Dumb Institution; Royal Blind Asylum and many others. There are four large libraries situated in the centre of the old town: the Advocates' Library, 550,000 volumes, the University Library, the Library of Writers to the Signet, 110,000 volumes, and the Public Library.

History.— The history of the city is largely the history of Scotland. Before the 11th century it did not figure more than as a fortified town, but in the time of David I it begins to be mentioned in charters under the name of Edwin'sburg. In 1128 the Abbey of Holyrood was founded by David I and between it and Edinburgh was the Canongate, which had a separate municipal authority down to 1856. The old wall of the city is said to have been built in 1450, and was extended after the battle of Flodden in 1513. The English under Hertford in 1544 burnt the city to the ground, with the exception of Saint Giles Cathedral, and 17 years later, Mary, on her return from France, took up her residence at Holyrood Palace. The modern history of the town is more associated with literature than with commercial and industrial enterprise.

Bibliography.—Maitland's 'History of Edinburgh' (1753); Arnot's 'History of Edinburgh' (1758); Crauford's 'History of the University of Edinburgh' (1808); Bower's 'History of the University of Edinburgh' (1817); Chambers' 'Traditions of Edinburgh' (1824); Steven's 'Heriot's Hospital'; Wilson's 'Memorials' (1890); Grant's 'Old and New Edinburgh'; and 'Burgh Record Society Publications'; Williamson, 'Edinburgh: An Historical and Topographical Account of the City'

(1906); Blaikie, 'Edinburgh at the Time of the Occupation of Prince Charles' (Vol. II of Old Edinburgh Club's Publications, 1909); Geddie, 'Romantic Edinburgh'; Fulleylove and Masson, 'Edinburgh Painted and Described' (1905); Watkeys, 'Old Edinburgh' (1913); Wierber, 'Story of Edinburgh Castle' (1913); and for its antiquities the annual volumes of the Old Edinburgh Club from 1907.

HEW MORRISON,
Chief Librarian, Edinburgh Public Library.
D. S. DOUGLAS,
Editorial Staff of The Americana.

EDINBURGH, University of, the youngest of the four Scottish universities, was originally known as "the College of Edinburgh," or "the Town's College," having been founded in 1583.

King James VI. in 1582, granted to the town council of Edinburgh a charter, conferring upon that body certain powers and privileges, and under this charter the Town's College, which afterward became known as "the College of James VI," was founded by the town council as a degree-conferring institution, and the University of Edinburgh remained under the control of the town council until 1858, when, by the Universities Act, all the universities of Scotland were made practically autonomous. From 1858 to 1889, the senatus academicus (that is to say, the principal and the professors) was the governing body of the university, but, by the Universities (Scotland) Act of 1889, the university court became the governing body, having full control of all the property belonging to the university. The senatus, however, still regulates the teaching and discipline of the university. The university court consists of the rector (the chosen representative of the undergraduates); the principal; the lord provost of Edinburgh for the time being; three assessors nominated by the chancellor, the rector and the town council, respectively; four assessors elected by the general council; and four assessors elected by the senatus.

The university has six faculties, *videlicet*—divinity, law, medicine, arts, science and music, each presided over by a dean elected by the separate faculties. In 1918 an ordinance constituting a degree in commerce (B. Com.) received the consent of the Privy Council, London.

The general council of the university consists of the chancellor, the members of the university court, the professors and the graduates. The council does not exercise any direct control in the government of the university, but "may make reports to the university court on all matters affecting the well-being and prosperity of the university, and the university court shall consider the same, and return to the council their deliverance thereon." The general council, together with the general council of Saint Andrews University, return a member of Parliament, who represents the two universities jointly. The chancellor of the university is appointed for life by the general council, and acts as president of that body. The general council is represented on the university court by four assessors elected every four years, two retiring biennially.

A students' representative council, elected annually, was founded in 1884, to represent the students in matters affecting their interests, and to afford a recognized means of communication between the students and the university authorities, as well as to promote the social life of the undergraduate community.

Enrolment as a student in one or more classes, the payment of the fees for such classes, the signing of the university album and the payment of a matriculation fee of one guinea per session (or half a guinea for a summer session only) are conditions precedent of matriculation. The matriculation fee entitles students to the use of the university library. The rector of the university, who presides over the university court, is elected by the matriculated students.

The university buildings consist of (1) the college or university (old building) in South Bridge Street; (2) the new buildings (school of medicine) Teviot Place; (3) the music classroom, Park Place; (4) the John Usher Institute of Public Health, Warrender Park Road, and (5) the engineering department, Infirmary Street. The old buildings of the university which were erected on the site of "Kirk o' Field," the scene of the murder of Darnley, contain the library and reading-rooms, the classrooms of the faculties of arts, divinity and law, the natural history and some of the science classrooms, the examination hall, the physical, geological and pathological laboratories, the Fulton Engineering Laboratory; the physical, geological, fine art and natural museums; the senate hall; the university courtroom and the officers of the senatus, the court and the students' representative council. The new buildings, begun in 1878, were partly opened for teaching purposes in 1880, being completed in 1888. They contain the lecture-rooms of the faculty of medicine (excepting those of botany, natural history and public health); the various museums connected with the medical faculty; a students' reading-room and common room; the faculty of medicine reception and reading-rooms, and the offices of the faculty.

Immediately contiguous to these new buildings, there was erected in 1901 the Hughes Bennett Physiological Laboratory, in memory of a former professor of physiology. The laboratory is connected directly with the other physiological laboratories and has been designed on the most modern lines.

The M'Ewan Hall was built between 1888 and 1897, and is a spacious hall of the early Italian renaissance style, capable of holding 2,600 people, and is used for all academic functions.

The John Usher Institute of Public Health was opened in 1902, and is equipped with the most modern appliances for teaching and research in bacteriology and chemistry. It is the gift of Sir John Usher, baronet, and was erected at a cost of over £21,000.

The new block of buildings for the engineering department was completed in 1905, and provides extensive accommodation for carrying on the work of that department.

The School of Music was built in 1858 from designs by the late Mr. David Cousin, and contains, in addition to the music classroom, an excellent organ, and museum of musical instruments.

The University Union, with extensions, has

cost over £37,000. It is situated in Park Place, near the M'Ewan Hall, and is held by trustees for the students.

The University Library, which contains over 270,000 volumes, and about 8,000 MSS., many of great value, was founded in 1580 by the transference from the town council to the university of a collection of books left to "Edinburgh and Kirk of God, thair to reman," by Mr. Clement Little. In addition to the University Library proper, there are separate libraries in connection with the following departments: Theological, classical, philosophical, historical, physiological, astronomical, modern languages, natural philosophy, engineering and music.

The income of the university is derived from benefactions and bequests for the foundation of bursaries, scholarships and prizes; from matriculation, graduation and other fees; from funds bequeathed for general purposes and for the endowment of chairs; and from parliamentary grants. The salaries of the principal and professors are paid from a fee fund account, the whole of the fees being pooled. The total net annual revenue is about £100,000.

Bibliography.— Bower, 'History of the University of Edinburgh' (3 vols., Edinburgh 1817–30); Crauford, 'History of the University of Edinburgh, from 1580 to 1646' (with Appendix, Edinburgh 1818); Dalzel, 'History of the University of Edinburgh from Its Foundation' (edited by David Laing, 2 vols., Edinburgh 1862); Grant, 'Story of the University of Edinburgh During Its First 300 Years' (2 vols., London 1884).

JOHN MINTO,
Librarian of the Signet Library, Edinburgh.

EDINBURGH REVIEW, the first of the great critical periodicals of the 19th century. It first appeared in October 1802, being started by Francis Jeffrey, Sydney Smith, Francis Horner and Henry Brougham. The original publisher was Constable and the printing was done by Willison. Of the first number 750 copies were printed; the demand soon exhausted this edition and 750 more were struck off. In six years the periodical reached a circulation of 9,000 and in 1813 it had about 13,000. Sydney Smith edited the early numbers but was soon succeeded by Jeffrey who made the *Review* a potent influence in Whig politics and also in the literary field. Its writers exhibited remarkable keenness of criticism, wit and brilliancy of style and the *Review* caused a sensation in the world of literature. Among the least pleasing episodes of its early period are its treatment of Southey, Wordsworth and other writers of the Romantic school. After the early period Macaulay was the most brilliant contributor. The *Review* is now published in London. Consult Napier, 'Life and Correspondence' (London 1862).

EDINBURGHSHIRE, or MIDLOTHIAN, a maritime county of southeastern Scotland; area, 234,329 acres. The Pentland Hills cross the county from the southwest, and the Moorfoot Hills are in the southeast. The uplands in the south are devoted to pasture; dairying is carried on in the west; and on the lowlands toward the Forth the soil is of remarkable fertility. Oats — for which the county is famous — wheat, barley and potatoes are the principal crops; paper, ale and brick are among the manufactures; coal and shale are extensively worked, and there are important quarries. The county returns one member to Parliament. Pop. 507,666, or exclusive of Edinburgh, Leith and Musselburgh, 80,922.

EDISON, Thomas Alva, American electrician and inventor: b. Milan, Ohio, 11 Feb. 1847. His family moved to Port Huron, Mich., when he was seven years of age, but he obtained no schooling, and at the age of 12 became a trainboy on the Detroit and Port Huron branch of the Grand Trunk Railway. While in this capacity, in 1862, he bought a small hand press and edited, printed and published a small paper of his own, naming it the *Grand Trunk Herald.* It had a circulation of 300 among the employees of the road. For the rescue of the son of a station agent he was taught telegraphy by the father and later became an operator at Mount Clemens, but, owing to his dislike of routine work, his fondness for reading and his inventive genius, he lost several subsequent positions and became a "tramp operator," although known to be remarkably proficient. While in Indianapolis in 1864 he invented an automatic telegraph repeater, the first of a long series of improvements and inventions. He soon after went to Boston, where he invented a commercial stock indicator, which he sold to New York capitalists for $40,000. This gave him the long-cherished opportunity of establishing an extensive laboratory, which he did at Newark, N. J., for the special manufacture of electrical printing, automatic and other apparatus. In 1876 his health failed and he gave up manufacturing, confining his labor to investigation and invention. He established his laboratory at Menlo Park, N. J., and later at West Orange, N. J., gave employment to hundreds of workmen and became known as one of the greatest inventors of the 19th century. More than 300 patents have been issued on his inventions and he has besides produced hundreds of minor contrivances and improvements not covered by patents. Among his more important inventions may be named the phonograph, a telephone for long-distance transmission, a system of duplex telegraphy (which he subsequently developed into quadruplex and sextuplex transmission), the carbon telephone transmitter, the microtasimeter, the aerophone, megaphone, the incandescent electric lamp, the kinetoscope and a storage battery for street railway cars and automobiles. There is not an electrical instrument or an electrical process now in use but bears the mark of some great change wrought by the most ingenious of Americans. In 1878 he was made Chevalier of the Legion of Honor by the French government, a commander of the Legion in 1889 and was the recipient of the insignia of a grand officer of the Crown of Italy bestowed the same year by King Humbert. In 1892 he received the Albert medal of the Society of Arts of Great Britain.

Among his commercial ventures were the magnetic treatment of iron ore and a Portland cement plant. The greatest of his later inventions is the nickel-iron storage cell, which is extremely rugged, is almost incapable of electrical injury and has a very high capacity per unit of weight. Its special use is the propulsion of vehicles and railway cars. Edison also invented a disc phonograph with a diamond-point repro-

ducer and other improvements. In 1913 by synchronizing his phonograph and kinetoscope he produced realistic talking motion pictures.

Edison is a man of remarkable personality. To those who believe his work is the product of an inspiration given by nature to but few, the story of the manner in which he achieves success will seem shockingly unromantic. In the genius who works by inspiration Edison has no great faith. "Genius is 2 per cent inspiration and 98 per cent perspiration," is the incisive, epigrammatic answer he once gave to a man who thought that a genius worked only when the spirit moved him. Not being given to scientific rhapsodies, Edison does not concern himself with what may be of service a century hence; he confines himself rigorously to the needs of the present. Knowing full well that he is probably not the first who has set for himself the task in the performance of which he is engaged, he reads all that is pertinent to his subject in the vast library which forms an important adjunct of his laboratory. Not content with the information gathered from his own shelves his literary agent is ordered to send him more. After a thorough review of his subject, Edison begins laboratory work — an expert keenly alive to the failures of his predecessors, careful to avoid useless repetitions of old experiments. It is now that the 2 per cent inspiration gained by exhaustive reading, and the 98 per cent perspiration which he is ready to expend, are applied. Experiments are made; not a few, but hundreds and even thousands. Model after model is built. Failure upon failure is met with, until further efforts seem hopeless. Undismayed, Edison performs more experiments, builds more models. Failure spurs him on. At last an experiment is performed or a model made which gives faint encouragement. So far from being elated, he regards the promising result with great suspicion. The failures have been too many; the apparent success after all may be due to an accidental combination of circumstances that may never occur again. Only after the partial triumph has been confirmed by many trials does complete assurance come. Edison knows exactly what he wishes to accomplish, and how his end is to be attained. Absolute certainty of purpose and of method saves him from frittering away his time in useless experimentation. Chance has given perhaps an occasional idea, but it has not lightened his work. Tireless perseverance and long hours of work are the secrets of Edison's success. In 1897 Edison devoted his exclusive attention to the invention of a new storage battery, on which problem he had been engaged for some five years. For over a year he worked harder than a day laborer. He was in his laboratory at 7.30 in the morning. His luncheon was sent to him. In the evening he left for dinner, but returned at 8. At 11.30 at night his carriage called for him; but often the coachman had to wait for three or four hours until the inventor came out of his laboratory. Yet when vacation time comes, and with it a chance to leave his laboratory, Edison plays just as he works, with his whole heart and soul. He will hear nothing of business. Science is thrown to the winds. Consult Dyer and Martin, 'Edison: His Life and Inventions' (2 vols., New York 1910); and Jones, 'Thomas Alva Edison' (ib. 1908).

EDISTO, a river in South Carolina, which has its rise in the southern part of the State and which flows in a general direction southeast into the Atlantic Ocean. Its source is at the junction of two streams called North and South Forks of Edisto River. The river is 150 miles in length and navigable for 100 miles.

EDITOR, The, (Redaktören), a play by Björnstjerne Björnson, appeared almost simultaneously with 'A Bankruptcy.' Both plays had been written in Italy and were published in Norway in 1875. They signaled the beginning of Björnson's career as an author of social dramas. In this respect he came a little earlier than Ibsen. While 'A Bankruptcy' met with a favorable reception both at home and abroad, 'The Editor' was ill received. Since it was a fierce attack upon modern journalism, it naturally roused the ire of the newspaper world, for it shows how the press exerts a most pernicious influence when in the hands of unscrupulous men. Björnson injects much personal feeling into the play. He was himself a liberal and had often been stung by the attacks of the conservative press. The "editor" is therefore represented as a conservative of the conservatives, and the author takes perhaps too keen a delight in pointing out the selfishness of the man. The "editor" is held forth as the very incarnation of evil, while his opponents, the liberals, appear like the angels of light. The standpoint of the author is that of tolerance, and the old doctor in the play is the spokesman of this philosophy. Björnson combats the doctrine that we must become hardened to the criticisms that are directed against us through the press or otherwise. Consult Jaeger, Henrik, 'Illustreret norsk literaturhistorie' (II, 589–639 and 711–768); Brandes, Georg, 'Det Moderne Gjennembruds Maend' (pp. 1–69, tr. by Mary Morison in a volume entitled 'Henrik Ibsen. Björnstjerne Björnson. Critical Studies. By Georg Brandes,' 1899).

JOSEPH ALEXIS.

EDMONDS, Richard Hathaway, American journalist: b. Norfolk, Va., 11 Oct. 1857. His parents were Virginians of English descent. His father died when he was an infant and his mother removed to Lancaster County, Va., where the family suffered many bitter experiences during the Civil War. In 1871 she removed to Baltimore where the boy received an education at private schools, and for two years at the City College of Baltimore. In 1875 he became clerk in the office of the *Journal of Commerce,* and was successively bookkeeper, reporter and editor until 1881, when he became identified with the founding of the *Manufacturers' Record,* devoted to the industrial and commercial interests of the South. As its editor he has been the author of its wonderful growth and powerful influence. Realizing the vastness of Southern resources and grasping their possibilities, he planned and labored ably and successfully for their development. As editor of the *Journal of Commerce* he wrote on the world's grain trade, becoming an authority on grain statistics. For the *International Review* he wrote a noteworthy history of the American grain trade after 1820. He is a trustee of the Southern Baptist Theological Seminary of Louisville. He has published numerous pamphlets about the South

and its resources; also 'Facts about the South' — an historical review of business conditions of the South before and after the Civil War. He has been active in advocating technical schools for the South. He is a member of the American Association for the Advancement of Science, and the American Academy of Political and Social Science.

EDMONDSON, Thomas William, American mathematician: b. Skipton-in-Craven, Yorkshire, England, 26 June 1869. He was graduated at London University in 1888, and at the University of Cambridge in 1891, studying later at Clark University, Worcester, Mass. He was assistant professor of physics and associate professor of mathematics at New York University from 1896 to 1905, when he became full professor of mathematics. He has published 'Worked Examples in Co-ordinate Geometry' (1891); 'Mensuration and Spherical Geometry' (with W. Briggs, 1893); 'Deductions in Euclid' (1901), also other mathematical textbooks.

EDMONTON, Canada. The city of Edmonton, capital of the province of Alberta, stands at an altitude of 2,158 feet, and is situated on both banks of the North Saskatchewan River about 800 miles west by north of Winnipeg and 946 miles east of Prince Rupert. It is approximately 300 miles north of the international boundary and lies a few miles south of the middle of the province. The site is picturesque, as the Saskatchewan at this point flows between banks 200 feet high and densely wooded. The name Edmonton is derived from the little town near London, England, to which John Gilpin took his famous ride. Throughout the 19th century the place was an important trading-post of the Hudson's Bay Company and it was only in 1916 that the moldering timbers of the old fort were finally demolished. With the advent of railway communication with Calgary in the early nineties, the town began to develop, and this development has proceeded steadily ever since.

On account of its strategic position at the old cross roads of north and south and east and west trade, Edmonton has become a remarkable railway centre. Thirteen lines of railway, operated by the Canadian Pacific, Grand Trunk Pacific, Canadian Northern, Edmonton, Dunvegan and British Columbia and Alberta and Great Waterways enter the city. Two of these are the transcontinental lines of the Grand Trunk Pacific and the Canadian Northern. The new northern railways leading to the Peace River country and to the McMurray district, celebrated for its tar sands, have already made Edmonton the distributing point for the rapidly growing commerce of the northern section of Alberta. Communication between the north and south sides of the city is provided by four steel bridges, the most important of which is an imposing structure crossing the river at a height of 200 feet. The legislative assembly is housed in a fine stone building.

Government.— The city government is composed of an elective mayor and council and a board of appointed commissioners. Municipally, Edmonton has become known as the exponent of the single tax and public ownership of all municipal utilities. The city owns and operates its own street car service, telephones, hospitals and waterworks. Whilst distributing and selling its own light and power, the city has recently surrendered to a private corporation the manufacture of power.

Religion and Education.— All the better known religious bodies are represented by substantial edifices. Edmonton is the seat of a Roman Catholic archbishop and an Anglican bishop.

The schools are managed by an elected board of trustees, and education is free and compulsory. There are two high schools, one on each side of the river, and a flourishing technical school. Higher education is provided by the Provincial University, a handsome building occupying a beautiful site of some 250 acres on the south side of the river. Commodious residential buildings for students and staff have also been provided. Robertson College and Alberta College, occupying its own building on the university grounds, are respectively the theological seminaries of the Presbyterian and Methodist churches and are in close affiliation with the University of Alberta. Edmonton is the site of an important meteorological station.

Industrial Progress.— The most important industry is perhaps coal mining. Lignite coal of a good quality is mined within the city limits and in the adjoining country. This supplies the local coal market, and a large trade is being developed in shipments to remoter centres. Stock-raising provides raw material for three extensive packing establishments, and in connection with these stock-yards have been established. The milling of cereals grown in the rich surrounding country is also a flourishing business and sure of healthful growth. Amongst other industries that have made a good start are brick-making, for which the local clays offer excellent material; dairy products, the manufacture and export of which are assuming large proportions; clothing, soap and biscuits. Natural gas has been found at Viking in territory close to Edmonton and the city will at an early date be furnished with this commodity. Cheap power is soon to be supplied from an extensive hydro-electric plant situated on the Saskatchewan west of the city Pop. (1911) 24,900; estimate in 1916, 55,000.

WILLIAM A. R. KERR,
Dean of the University of Alberta.

EDMONTON, England, town in the county of Middlesex, on the New River, eight miles north of London. The "Bell at Edmonton" has become famous by association with the adventures of John Gilpin, the hero of Cowper's poem. Charles Lamb died at Edmonton in 1834.

EDMUND, Saint, king of the East-Angles: b. Nuremberg, 841; d. Oxen, now Hoxon, England, 20 Nov. 870. Edmund belonged, by blood, to the English-Saxon kings, but was not a direct heir to the throne. When Edmund was only in his 15th year he was crowned by Humbert, bishop of Elma, on Christmas Day 855, at Burum, a royal villa on the Stour, now called Bures. In the 15th year of his reign the land was attacked by the Danes, and they laid waste all the country through which they passed. The king tried to protect his people, but the Danes outnumbered them and spared none.

He was captured at Oxon and terms, prejudicial to religion, were offered and rejected. Hinguar, the Dane, ordered most terrible tortures to be inflicted. Again he was offered terms of surrender, and again he refused. Hinguar at last ordered his head to be cut off.

EDMUND, Saint, archbishop of Cantonbury: b. Abingdon, England, about 1190; d. Soissy, France, 16 Nov. 1240. His first studies were made at Oxford and from there he was sent to Paris, where he devoted himself to the study of theology and the Scriptures, and for a time taught the Scriptures in Paris. Returning to England, after his ordination, he became a teacher at Oxford from 1219 to 1226; he was the first who taught Aristotle's logic at Oxford. He desired to work among the poor, and at his own request was transferred to Salisbury Cathedral. While at Salisbury he received a commission from the Pope to preach the crusade against the Saracens, which he did with effective results. In 1234 Pope Gregory IX appointed Edmund as archbishop of Canterbury. He at once entered upon a series of reforms in courts, monasteries and among his clergy. His 'Constitutions' in 36 canons, dealing with matters of reform, are still extant. Troubles arose between Edmund and the king, when the king's greed sought various means to secure Church revenues. Both the archbishop and the king appealed to the Pope, who, failing to finally settle the disputes, left the archbishop almost powerless to cope with adversaries. Fearing that by remaining he might seem to sanction what he could not redress, he left the country secretly and went to France. He was canonized in 1246, only four years after his death. Some of his works extant are 'Constitutions,' to be found in 'Editions of the Councils' by Linwood, Spelman, Wilkins, Johnson and Labbe; 'Speculum Ecclesiæ,' or 'Mirror of the Church'; and several of his works in manuscript, one on the Sacraments, are in the Bodlein Library, Oxford. Consult Wood, 'History and Antiquity'; Tanner, 'Notitia Monastica'; Butler, 'Lives of Saints,' and the 'Life' by Ward, (1903).

EDMUND I, or **EADMUND,** king of England: b. about 921; d. 26 May 946. He was a son of Edward the Elder and succeeded his brother Athelstan in 940. At the battle of Brunanburh, in 937, he distinguished himself. He subdued Northumbria and the Five Danish Boroughs in 944, and in the following year conquered Cumbria, which he bestowed on Malcolm, king of Scotland, on condition of homage. He was killed at a banquet by Liofa, an outlaw.

EDMUND II, or **EADMUND** (surnamed IRONSIDE), king of England: b. about 981; d. 30 Nov. 1016. He was a son of Ethelred II, and on the latter's death in 1016 was chosen king at London, whilst Canute was elected to the same dignity at Southampton. Edmund several times defeated the forces of the Danish ruler, but was himself defeated at Assandun (now Ashington) in Essex. A compromise was then effected, by which the midland and northern counties were assigned to Canute and the southern to Edmund. On Edmund's death, a few weeks after this treaty, Canute became king of England. Consult Oman, 'England before the Norman Conquest' (London 1910).

EDMUNDS, Albert Joseph, American librarian: b. Tottenham, Middlesex, England, 21 Nov. 1857. In 1877 he entered the University of London, was secretary to T. W. Backhouse, the astronomer, from 1879 to 1883, and emigrated to the United States in 1885. From 1887 to 1889 he was assistant librarian of Haverford College; in 1889–90 he classified the Philadelphia Library and since 1891 has been cataloguer of the Historical Society of Pennsylvania. He has published 'English and American Poems' (1888); 'Songs of Asia Sung in America' (1896); 'Marvelous Birth of the Buddhas' (1899); 'Hymns of the Faith' (Dhammapada 1902); 'Buddhist and Christian Gospels' (1902; 3d ed., Tokio 1905; 4th ed., Philadelphia 1909, with important postscripts in 1912, 1914; Italian translation, Palermo 1913); 'Buddhist Bibliography' (1903); 'Buddhist Texts in John' (1906; 2d ed., 1911); 'Fairmount Park and Other Poems' (1906); 'Buddhist Loans to Christianity' (1912); 'Duet with Omar' (1913); 'History Simplified' (1914); 'Hoag's Vision' (1915).

EDMUNDS, George Franklin, American lawyer: b. Richmond, Vt., 1 Feb. 1828. He received a common school education, as well as the instructions of a private tutor; studied law, and began its practice in 1849. In 1851 he removed to Burlington, Vt. He was a member of the Vermont legislature 1854–59, being speaker 1856–59, and was a member of the State senate, and its president 1861–62. He was by this time very prominent in Vermont politics, and at the opening of the Civil War, when a State convention assembled with the intention of uniting war Democrats and Republicans, he outlined the resolutions which the convention finally adopted as the principles of union. On the death of Solomon Foot, in 1866, Edmunds was elected to the United States Senate to fill Foot's unexpired term, and was thrice re-elected for full terms, resigning in 1891. During his quarter-century in the National Senate he served on many important committees, displaying the qualities of an able, accomplished statesman. He was a member of the electoral commission in 1877, and was the author of the act of 22 March 1882 known as the "Edmunds Act" (q.v.), which provided for the suppression of polygamy in Utah and the disfranchisement of any person convicted of practising it. He was also the author of the "Anti-Trust Law" of 1890. During the term of President Arthur he was president pro tempore of the Senate. In 1897 he became chairman of the monetary commission which had been appointed by the executive committee of the Indianapolis monetary conference. After his retirement he devoted himself to his profession, and gained wide fame as a constitutional lawyer.

EDMUNDS ACT, passed by Congress 22 March 1882; an act to root out polygamy in Utah, not only by direct punishment but by barring out votes, public careers and official action from polygamists. Mormons held control of the Territory not only through the local offices, but from the fact that all juries were composed of Mormons who would not convict their fellows or admit evidence of polygamy; and the act not only disfranchised but excluded from juries all who either practised polygamy or believed it rightful. The disfranchisement was even more effective, as Utah had woman

suffrage, and each polygamous wife was disfranchised also. The act made the living with more than one woman in marital relations a misdemeanor.

EDMUNDSON, George, English clergyman and historian: b. Redcar, Yorkshire, 1848. He was educated at Magdalen College, Oxford, and entered the ministry of the Church of England in 1874. He is best known as a student of the history of the Low Countries and of South America. From 1901 to 1904 he was engaged in the preparation of the British case in the Guiana-Brazil boundary dispute. He was a contributor to the 'Cambridge Modern History' and published 'Milton and Vondel' (1885); 'Archbishop Laud and his Work' (1905); 'Anglo-Dutch Rivalry in the First Half of the 17th Century' (1910); 'The Church in Rome in the First Century' (1913).

EDOM, ē'dŏm, in the New Testament, IDUMÆA, in ancient times a country lying to the south of Palestine in the region of Mount Seir. The Edomites are said in Genesis to be the descendants of Esau. They were subdued by King David, and after the separation of the 10 tribes remained subject to the kingdom of Judah till the reign of Jehoram, when they revolted and secured their independence for a time. They were again subdued by Amaziah and again in the reign of Ahaz, recovered their independence, which they maintained till the time of the invasion of Judea by Nebuchadnezzar. They fell under the rule of the Persians, and latterly their fortunes were merged in those of Arabia.

EDRED, king of England: d. Frome, England, 23 Nov. 955. He was a son of Edward the Elder, and succeeded to the throne on the murder of his brother, Edmund I, in May 946. He quelled a rebellion of the Northumbrian Danes, and compelled Malcolm, king of Scotland, to renew his homage for his English possessions. Edred died after a reign of nine years, and left the crown to his nephew, Edwy.

EDRISI. See IDRISI, ABU ABALLAH MOHAMMED.

EDSALL, Samuel Cook, American Protestant Episcopal bishop: b. Dixon, Ill., 4 March 1860. He was educated at Racine College; read law and was admitted to the bar in 1882. He soon abandoned this profession, entered the Western Theological Seminary and was ordained to the Protestant Episcopal ministry in 1889, becoming rector of Saint Peter's Church, Chicago, in the same year. After 10 years in this charge he became missionary bishop of North Dakota; in 1901 was elected coadjutor bishop of Minnesota and in the same year was translated as bishop. He is author of 'Prayer Book Preparation for Confirmation' (1898).

EDSON, Cyrus, American bacteriologist: b. Albany, N. Y., 8 Sept. 1857; d. 1903. He was graduated at the New York College of Physicians and Surgeons in 1881 and in the following year was appointed a sanitary inspector. In 1893–95 he was health commissioner of New York. He discovered a new treatment for consumption, malaria and other germ diseases, in 1896, which he named aseptolin. His publications include about 80 papers on medical and sanitary subjects. He was the inventor of many surgical instruments.

EDUCATION, Abnormal. See EDUCATION OF FEEBLE-MINDED AND MENTAL DEFECTIVES.

EDUCATION, Adult. The conviction that the duty of society in the education of its members does not cease with the completion of a school or college course has gained ground during the last decade. Because of this, widespread efforts to educate the adult have been made with varying results. On the whole the progress has been satisfactory, yet a co-ordination of effort and a scientific plan is still lacking. The National Society for Broader Education, organized in New York 1910, is the only organization for adult education that has a definite plan and actually covers the entire country. The Society with its headquarters at Carlisle, Pa., has, however, because of lack of funds, limited its activities to economic, sociological, literary and musical fields. In 1917 it gave 7,796 lectures, concerts, talks. It gave 32 addresses for every day of Society's working year of nine months. Its audiences, including classes, numbered 1,339,907, or 5,583 persons every working day. In addition to its field work, the National Society for Broader Education maintains scholarships in many colleges and universities. Its staff in 1917 numbered 176 persons. Adult education has been hampered by the lack of suitable meeting places. Satisfactory halls existed but the rental charged precluded their use. The National Society for Broader Education organized a country-wide campaign for the open schoolhouse. Various educators either working with the Society or independently aided the movement. As a result of the effort, a canvass of 603 cities of over 5,000 inhabitants made by the Russell Sage Foundation showed that schoolrooms in these cities were used after class hours for the instruction of the adult. In 294 cities for miscellaneous educational activities, in 219 for lectures, in 207 for meetings of Parent Teachers Association, 129 as social centres and in 39 for vacation schools. In 11 States in 1917 grants were made for the education of the alien adult but these efforts have only been a beginning of a needed work. Minnesota and Wisconsin are the most active and most successful States in adult education and New York city has for years stood pre-eminently first among the cities in its provision for adult instruction. The 25th annual report of the supervisors of lectures of the New York Board of Education showed that in 1917 there were 174 lecture centres, 676 lecturers speaking on 1,695 topics before 5,405 audiences. Total aggregate audience was 1,154,066, an average of 214 per lecturer. For 25 years these lectures have cost the city of New York about $150,000 annually. The University of Minnesota has carried the University atmosphere over the State, reaching 25 towns on each year's circuit. University week is a six-day program conducted in each of the towns listed throughout the State, during which effort is made to present in epitome as many as possible of the widespread activities of the University. Members of the University faculty lecture on a great variety of subjects, the glee club gives concerts, debating societies hold debates, the dramatic club gives performance as do musical organizations and there are talks to business

men at noonday luncheons and women's clubs in the afternoon. The University of Wisconsin is a pioneer among educational institutions in establishing a school film exchange as one of the means of solving the motion picture problem. Motion pictures are used by several churches, among them the Grace Methodist Episcopal Church and Saint Bartholomew's Episcopal Church of New York city. They give on Sunday afternoons pictures of travel through Palestine, biblical scenes and events in the history of the Church. It is generally conceded that the public has in its hands the ultimate development of the motion picture. The public has been importuned to demand a high grade of pictures. Many public schools and other educational institutions are now furnishing films to students and sending them out to the general public when centres are organized for their reception and exhibition. In 1891 New York State appropriated $10,000 for adult education, it was the first State appropriation. Work was classified under title "Home Education" and included "Study clubs, exchanges, traveling libraries, public libraries and library schools." Similar work was begun in Chicago in 1892 but quickly abandoned when the University of Chicago incorporated this work as part of its activities. In December 1891 a National Congress on Adult Education and University Extension met in Philadelphia, at which it was reported that in the four years, 1887–91, 28 States and Territories had begun adult education in some form. This work was relatively unorganized and there was no organized adult education before 1892, and in that year organization in two institutions only, University of Chicago and University of Wisconsin. Between 1906–13, 28 institutions organized adult education and 21 institutions reorganized the work in addition to 12 institutions which had begun the work between 1892 and 1906. Modifications and gradual change of methods have taken place in the last 10 years. It has been decided that the English plan of lectures, class work, syllabi, collateral reading and more or less rigid examinations was not well adapted to the larger part of the adult student body in America, whose need was great for educational opportunities offered out of work hours. Modifications were introduced and in quick succession departments were added including the educational bulletin and package library, and of welfare work covering the entire field of civic and social betterment. Adult education now includes all extra-mural university service, and certain types of intra-mural work. Under the latter head are included institutional short courses and conferences and opportunities to attend classes or lectures out of work hours as are offered sometimes with and sometimes without the customary entrance requirements. Of institutions offering education to adults, 20 give degrees. In addition to the above-mentioned institutions with organized work in adult education, 52 colleges and universities give more or less attention to the subject. In adult education great service has been done by the General Federation of Women's Clubs, with its 9,000 clubs, its 50 or more federations, and 3,000,000 members working through 12–15 departments. The Federation stands for better homes, better schools, better things for men, women and children and a broader vision of life. Among its departments are art, music, literature, civics, library extension, conservation of public health, social and industrial conditions, social hygiene, child hygiene, legislation, home economics and education. One praiseworthy activity is the rural welfare service through which town club women invite the farm women to a "get acquainted meeting" at which informal discussion of school and other problems is subordinated to visiting and general social enjoyment.

Correspondence has played an important part in adult education. Though organized as business enterprises several of the schools of correspondence may be classed as private educational institutions. As a factor in the educational problem they are of great importance. Several of the correspondence schools serve at one time anywhere from 1,000 to 35,000 students, with faculties running as high as 350 persons, with, in addition, as many as 400 text and lecture writers and examiners. The average age of those taking course is about 30. Music, through the Music League of America and other musical organizations, and drama, through such societies as the Drama League of America, have done much for the æsthetic side of adult education. The Drama League of America, now in its seventh year, was founded on the belief, according to Richard Burton, its president, in 1914, that the drama is fast becoming an appreciable and important part of American literature. The league refuses to censor or attack bad plays. It believes that it is most effective to call attention to that which is good. This is done through the agency of a play-going committee reporting through a bulletin system inaugurated in Chicago, the birthplace of the League. The National government is perhaps the most active agency in adult education and this chiefly through public documents. During year ending 30 June 1915, 34,714,186 copies of government publications were mailed free and 3,252,919 copies were sold. These publications report legislative, executive, financial, postal, military and naval functions common to all governments, comments on world activities and the results in popular printed form, for the instruction and practical use of all the people, of scientific investigation, covered by the United States.

GUY CARLETON LEE,
Managing Director, National Society for Broader Education, New York.

EDUCATION, Agricultural. The methods of scientific instruction in all branches of farming.

Historical.— Most of the early attempts to establish systematic agricultural instruction were made through schools of secondary grade. This was the natural consequence of the fact that the early development of agriculture was largely dependent on the development and application of chemistry. The two earliest colleges of agriculture to be established were at Hofwyl in Switzerland and Krumau in Bohemia. They were started in 1797. The former exerted a marked influence upon the development of agricultural education, especially that of a secondary grade. Its influence was felt in this country through the pupils that were drawn from this country and by the work of

"Association of the Fellenberg System of Education."

The first professorship of agriculture in a collegiate institution in this country was held by Samuel L. Mitchill of Columbia College. He also held chairs in natural history and chemistry at the same time. The position was established in 1792. Just when the first school devoted largely to the interest of agriculture was established in this country is difficult to determine. During the early part of the 18th century a large number of agricultural societies were active and many of these organizations were interested in promoting systematic instruction in agriculture. The writings of Washington, Franklin and Jefferson bear testimony to their interest in the subject.

In spite of the fact that it is difficult to determine the beginnings of schools of agricultural instruction, it is relatively easy to decide upon the first institution in this country that attained such a measure of success that it attracted general attention. This honor belongs to Gardiner Academy which was established at Gardiner, Me., in 1821. In the legislative act providing for its incorporation it is stated that it was "designed to prepare youth by scientific education to become skillful farmers and mechanics." In 1823 the legislature made provision for some aid from the State treasury. This was undoubtedly the first State aid that was ever granted to an agricultural school in the United States. This institution had a fair measure of success for several years but was finally forced to close its doors in 1823, because of decline in student body and a lack of financial support. Many other attempts were made with varying degrees of success to found schools during the first half of the 19th century, but none met with a marked degree of success. All declined after, at most, a few years of existence. Among these institutions may be mentioned Agricultural Seminary, Derby, Conn., 1824; Cream Hill School, West Cornwall, Conn., 1845; Farmer's College, College Hill, Ohio, 1833; Fellenberg School, Whitesborough, N. Y., 1831; and Mount Airy Agricultural College, Mount Airy, Pa., 1847.

The movement for agricultural education began to assume more serious proportions when efforts were made to secure State and Federal aid for the support of agricultural colleges. To whom the credit belongs for these suggestions is impossible to say with certainty. It is agreed, however, that through the influence of far-seeing men in several sections of the country pressure was exerted in behalf of State and Federal support of colleges of agriculture at about 1850.

In Pennsylvania the present State College is due to the activity of the State Agricultural Society that took definite steps in 1850–51 to secure an agricultural school. In New York State several attempts were made but all of the early ones were without great measure of success. To the State of Michigan belongs the honor of having the oldest college of agriculture in North America. This institution is also the first to be established entirely on the basis of State support. The State Constitution adopted in 1850 made provision that the State legislature should establish and maintain a college of agriculture. The law providing for its establishment became effective 12 Feb. 1855. Immediately a bitter fight followed over the location of the institution. There was a decided effort made by those who were interested in the State University to have the College of Agriculture made a part of that institution. This movement was opposed by the State Agricultural Society and this organization was successful as the college was finally located at East Lansing. This location, apart from a literary institution, is of considerable interest because of the influence that it exerted upon the establishment of "separate" colleges of agriculture after the passage of the Land Grant Act. In the early years of the agricultural colleges the separate institutions had a more substantial development than did those that were made a part of existing colleges or parts of State universities. The colleges that were made a part of a university were very slow to find themselves, but their growth in recent years has been of such a nature as to justify the views of those who believed they should be a part of a university.

On 16 Feb. 1857, the State legislature of Michigan appropriated $40,000 for the erection of buildings, instruction and maintenance for the years of 1857 and 1858. The institution opened to receive students 13 May 1857. State supported colleges of agriculture were established in Pennsylvania and Maryland in 1859.

Land Grant Colleges.— Undoubtedly there would have been a gradual development of colleges of agriculture on the basis of State support, but even before the establishment of the Michigan College of Agriculture there had been proposed plans for Federal aid. To whom the credit for this suggestion belongs is in doubt. Probably it had independent origin in the minds of several men. The first bill introduced in Congress touching on this subject was offered by Justin P. Morrill in 1857. At that time Mr. Morrill was a member of the House of Representatives from the State of Vermont. This bill made provision for granting to each State 20,000 acres of land for each senator and each representative in Congress. It was finally passed 7 Feb. 1859. It was, however, vetoed by President Buchanan. The matter then rested until after President Lincoln's election, when Mr. Morrill again introduced a bill, drawn on lines similar to the previous measure except that it made provision for granting 30,000 acres of land to each State for each senator and representative in Congress. This measure became a law on 2 July 1862, when President Lincoln's signature was affixed.

It provides that the income from these lands shall be used by each State which accepts the benefits of the act "to the endowment, support and maintenance of at least one college where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and mechanic arts, in such manner as the legislature of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." A supplementary act was passed in 1866 by which provision is made so that when any Territory becomes a State it is entitled to the benefits of

the Act of 1862, or the First Morrill Act as it is commonly called.

The Second Morrill Act became a law 30 Aug. 1890. This act provided for an initial allotment to the States of $15,000 per year with an automatic increase of $1,000 annually until the sum of $25,000 was reached in 1900. The purpose of this legislation was for the "more complete endowment and support of the colleges for the benefit of agriculture and mechanic arts established under the provisions of an act of Congress, approved July second, eighteen hundred and sixty-two." Under the terms of this law, there is provision for the division of the funds between colleges for white and colored students in States where separate institutions are maintained.

The Nelson amendment was approved 14 March 1907. This provided for an increase of $25,000 a year to the allotments made under the Second Morrill Act. The initial grant was $5,000 and was subject to an annual increase of $5,000 until the maximum of $25,000 was attained. Under the two acts, the Second Morrill Law and the Nelson Amendment, the annual grant to each State is $50,000.

Through the provisions of the three acts there has been a marked development of State colleges of agriculture. As a result there are at the present time 67 of these institutions including those for colored students. There are 17 of these. In 1915 the total income of the land grant colleges was $31,961,765, of which amount only $3,552,077 came from Federal sources. According to a report from the United States Bureau of Education there were in 1915–16 private colleges to the number of 16, giving instruction in agriculture.

The debates that took place in Congress at the time of the passage of the First Morrill Act showed no clear conception as to what these colleges when established were to accomplish. It is also true that much diversity has been shown in the use of the funds by the States. In some of the eastern States the land grant was turned over to privately endowed colleges that were in need of funds and in the Middle West in some cases the grants were used as a basis for the establishment of State universities. In spite of these facts in the half century that has elapsed since the passage of the first act strong institutions have been developed that have come to have clearly defined aims and fairly definite means of attaining those ends. At present, in most of the institutions three lines of activity are clearly defined: viz., resident teaching, research and extension.

Teaching.— The courses offered by the institution are usually of two classes; long courses, four years of the usual length of a college year; and short courses which are commonly two years in length but of only 10 or 12 weeks duration each year In addition most institutions make special provision for the adult student who cannot meet the entrance standards.

The admission requirements to the four-year courses are in general as high as those for admission to other college courses. The completion of the course leads to the degree of B.S. or B.S.A. The subjects taught include such basic sciences as chemistry, botany, zoology, mathematics, geology and meteorology. In addition English and political economy are usually required subjects. The applied subjects are represented by farm crops, farm management, rural engineering, soils, breeding, agronomy, animal husbandry, rural or agricultural economics, poultry husbandry, rural education, entomology, fruit growing, vegetable gardening, floriculture, forestry, landscape art, dairy industry and agricultural chemistry. The relation between the basic and applied subjects varies in the different institutions but usually it comes between the limits of one-third and one-half.

During the year of 1915–16 there were 16,008 students in the four-year courses and in addition 10,332 students in one- and two-year courses. To these figures should be added 2,053 four-year students in agricultural colleges for negroes. This is quite in contrast with the early experience of the colleges when they had almost no student body. Statistics from bulletin number 10 of the Carnegie Foundation show the student body in these institutions grew rapidly from 1894–95, 2,712, to 1914, 14,844.

Since the land grant colleges are supported by the State and National governments, they have felt the need from an early date of providing instruction through short or winter courses for students who did not have the time to attend during the regular academic year or who may have lacked entrance requirements. Many early attempts were made at courses of this character but the University of Wisconsin is generally credited with having established the short course on its present day basis. This course was opened in 1888 and has run each year since that time. These courses vary in length at different institutions but usually they are from 4 to 12 weeks in length and continue for one or two years. The work that is offered is of an extremely practical nature. That it is meeting a demand is attested by the fact that there were 14,108 short-course students in the colleges of agriculture during the year of 1915–16. It is quite likely that with the development of agricultural instruction in the public high schools and special secondary schools that this phase of the work may decline at the colleges.

In recent years many of the colleges are offering summer courses of 6 to 12 weeks' duration to teachers. The need for this work has been especially pronounced as a result of the development of agricultural instruction in the elementary and secondary public schools.

Research.— Almost from the beginning of instruction in the colleges of agriculture some of the instructors devoted a portion of their time to investigation. This was made necessary by the relatively small body of agricultural knowledge that was established on a scientific basis and organized for teaching purposes. As a result of provisions of the Federal acts encouraging agricultural research most of the experiment stations are organized at the State colleges of agriculture. Commonly, the investigator is a member of both college and experiment station staffs. The results of the experimental work are usually distributed by means of bulletins that are published both in technical and popular form. See AGRICULTURAL EXPERIMENT STATION.

Extension. This term is usually applied to the instructional work that is conducted with students who are not resident at the college.

It covers a wide range of activities such as correspondence courses, which have been especially developed in Pennsylvania and California, demonstration schools, farmers' institutes, demonstration plots, lectures, reading courses, county agents, home demonstration agents and boys' and girls' club work. Almost from the beginning colleges of agriculture have felt the pressure for such work, because they are State supported and also as they had to establish themselves with the farmers.

The first State law making specific appropriation for extension work was probably the Nixon Act which was passed by the New York State legislature in 1894. At the present time practically every college of agriculture has an extension department with a head who is usually designated extension director. There are approximately a thousand extension specialists home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications, and otherwise; and this work shall be carried on in such manner as may mutually be agreed upon by the Secretary of Agriculture and the State agricultural college or colleges receiving the benefits of this act."

By the provisions of this act, $480,000 were appropriated for the first year, $10,000 of which went to each State accepting the provisions of the act. For the succeeding year there was an appropriation of $600,000 and this will increase annually at the rate of $500,000 until the sum of $4,580,000 is attained. These grants, except the $480,000, are "allotted annually to each State by the Secretary of Agriculture in the

FUNDS AVAILABLE FOR COOPERATIVE AGRICULTURAL EXTENSION WORK, CLASSIFIED BY ORIGINAL SOURCES

	1914–15	1915–16]	1916–17	1917–18]
Federal government:				
Farmers' co-operative demonstration work.	$905,782	$914,290	$943,088	$1,037,501
Other bureaus	105,168	157,621	121,609	182,708
Federal Smith-Lever	474,935	1,080,005	1,580,000	2,080,000
Total	$1,485,885	$2,151,916	$2,644,697	$3,300,209
Within the State:				
State:				
Offset	.....	$459,046	$904,090	$1,241,266
Other State	$711,516	696,405	597,105	530,564
Total	$711,516	$1,155,451	$1,501,195	$1,771,830
County:				
Offset	.....	$68,004	$83,614	$202,846
Other county	$815,732	939,668	1,246,288	1,544,366
Total	$815,732	$1,007,672	$1,329,902	$1,747,212
College:				
Offset	.....	$38,099	$63,910	$83,101
Other college	$346,750	209,682	142,524	198,644
Total	$346,750	$247,781	$206,434	$281,745
Other:				
Offset	.....	$34,850	$48,384	$72,784
Miscellaneous	$247,352	273,951	372,546	443,307
Total	$247,352	$308,801	$420,930	$516,091
Total within States	$2,121,350	$2,719,705	$3,458,461	$4,316,878
Grand total	3,607,235	4,871,621	6,103,158	7,617,098

on the faculties of the agricultural colleges. Much of the stimulus for this work and plans for its organization have come through the Smith-Lever Act which became effective 8 May 1914. This law differs from the previous acts in which Federal funds were granted to the States for the development of agriculture, in the fact that the National government retains a larger measure of control than in any previous legislation. This is done by making the funds available only for co-operative extension work that is carried on by the land grant colleges of agriculture and the United States Department of Agriculture. The nature of this co-operative work is set forth in section 2 of the law as follows:

"Cooperative agricultural extension work shall consist of the giving of instruction and practical demonstrations in agriculture and proportion which the rural population of each State bears to the rural population of all the States as determined by the next preceding Federal census." In order to secure the benefits of the act an amount equal to that coming from the Federal government must be appropriated from sources within the State. The law is administered through the States Relations Service of the United States Department of Agriculture.

The most notable developments under this act have been the systems of county agents home demonstration agents, and boys' and girls' club leaders. March 1, 1918, there were co-operatively employed 2,645 county agents 1,514 home demonstration agents and 441 boys' and girls' club workers. Not all of these persons are employed on permanent funds as 2,950 are emergency agents put into the co-operative

work for the purpose of stimulating agricultural production and food conservation after our entrance into the war with Germany. This act was made possible by an emergency appropriation of $4,350,000. The table on the preceding page, furnished through the courtesy of the States Relations Service, shows the growth of the co-operative extension work since the passage of the Smith-Lever Act.

The various Federal acts relating to instruction, research and extension in agriculture have resulted in the development of a group of strong institutions that are making their influence felt throughout the entire country. In 1918 there were 67 state and federally supported institutions of college grade giving instruction in agriculture, 17 of which were for negroes. In 23 States and Porto Rico the college of agriculture is a part of the university. Tuition is free to residents of the State in which the college is located in most cases. There were 7,066 persons engaged as instructors or investigators in these institutions.

Foreign Countries.—The most widely known college of agriculture in Canada is the Ontario Agricultural College at Guelph. This institution was established in 1874. Several other colleges have been established since that time. In addition to its collegiate instruction in agriculture Canada has done much to encourage the introduction of agriculture into the rural high and elementary schools.

The first chair of agriculture in England was established in the University of Edinburgh in 1790. In 1838 the Albert Agricultural College was founded at Glasnevin, Ireland, as a state-supported institution. The Royal College of Agriculture was established at Cirencester, England, in 1845. There have been other colleges opened for the purpose of giving instruction in agriculture and in addition there are a considerable number of other colleges giving agricultural instruction. National aid is given to this work through the Board of Agriculture and Fisheries.

The Institut National Agronomique de Paris, which is supported by the national government, stands at the head of the French system of collegiate instruction in agriculture. In addition there are three national schools, one each at Grignon, Rennes and Montpelier. France has an excellent system of secondary schools of agriculture, some of which are specialized in their work and others give general instruction. There are also chairs of agriculture in many lyceums and colleges. Since 1879 instruction in elementary agriculture and horticulture has been obligatory in the normal and primary schools. Institutions for giving instruction in agriculture both of college and secondary grade are to be found in most of the civilized countries of the world.

Secondary Schools.—As has been noted most of the early efforts to give instruction in agriculture were made in schools of secondary grade. Numerous attempts were made to establish "farm schools" in the East and Middle West during the first half of the 19th century. While some of these met with a measure of success, sooner or later they were compelled for one reason or another to close. It was not until 1888 that a permanent secondary school of agriculture was established. This was the Minnesota State School of Agriculture, located at Saint Anthony's Park, in connection with the State College of Agriculture. Following the opening of this school there came a period in which there was considerable development of special secondary agricultural schools. In 1915–16 there were 28 such schools maintained by State colleges of agriculture, 74 special agricultural schools receiving State aid, and 12 private agricultural schools of secondary grade. These special schools have in some cases been supported entirely by State aid and in other instances by a combination of State and local funds. The unit of territory that they attempt to serve varies greatly. In some cases, e.g., New York and Minnesota they have been supported entirely by the State, and no boundaries set from which students may come, within the State. In Wisconsin the county has been made the unit and the schools are supported by State and county. In Georgia and Alabama a school was established in each congressional district, in Oklahoma the judicial district was made the unit, while in Arkansas the State was arbitrarily divided into four districts.

The length of the courses varies from one to four years with the most common length two years except in the district schools of Alabama and Georgia where the four-year course is the rule. The admission requirements very properly are not high for most of these institutions. Completion of the elementary school is expected, except for students over 16 who are commonly admitted regardless of previous academic preparation. In most of these schools the instruction is designed to meet the needs of boys who have come from the farm and who expect to return to it without further opportunity for study. In addition to the instruction in such agricultural subjects as farm crops, soils, animal husbandry, farm management, fruit growing, poultry husbandry, and dairying, the students have work in English, civics, arithmetic, and some basic science work. In these institutions the tendency has been to follow too closely in the footsteps of the colleges of agriculture so far as organization and presentation of the work are concerned. Most of the schools are provided with a farm.

It was noted in connection with the "separate" colleges of agriculture that in the early stages they developed more rapidly than did those that were a part of a university. When the later class finally started they had a more substantial growth. A striking parallel occurs in the development of agriculture instruction of secondary grade. The first few years of its growth the special schools were prominent and there were few agricultural departments in high schools. These, however, are developing rapidly in recent years. In 1915–16 there were 421 State-aided vocational departments of agriculture in public high schools and 2,981 public high schools teaching agriculture. In the vocational departments the course of study is commonly four years in length although frequently short courses are also offered. In other high schools the courses commonly run from a half year to two years.

February 23, President Wilson signed the Smith-Hughes bill for vocational education. This measure which makes provision for Federal aid to the States for vocational education in agriculture, trade and industrial subjects, and home economics, is certain to exert a marked influence upon the development of secondary

agriculture. Like the Smith-Lever Act this law makes the development of vocational education in agriculture a co-operative enterprise between the various States and the Federal government. The law went into operation 1 July 1917 and provides Federal funds to the amount of $500,000 for the stimulus of vocational education in agriculture. This amount is increased by $250,000 annually until $2,000,000 is reached when it is increased to $3,000,000, which is the maximum, by annual increments of $500,000. This money is appropriated among the States in the proportion that the rural population of each State bears to the total rural population of all the States. In order to receive the benefits of this act there must be expended from sources within the State an amount equal to the amount received from the National government. The instruction must be designed for pupils over 14 years of age but it must be below college grade. The law further provides that the funds must be expended through State supported or supervised schools, and arrangements must be made so that pupils obtain at least six months of practical experience each year. The law makes provision for the preparation of teachers of vocational agriculture.

This act is administered by the Federal Board for Vocational Education which consists of a representative of labor, a representative of agriculture, a representative of trade and industry, and the following ex-officio members; secretary of agriculture, secretary of commerce, secretary of labor and the commissioner of education.

In all of the early attempts to develop agricultural instruction in secondary schools it was considered necessary to maintain a farm. In recent years the home project plan, which has been developed largely through the efforts of R. W. Stimson of Massachusetts, has proved more satisfactory as a means of affording vocational experience. The home project is ordinarily a productive enterprise that is an outgrowth of the school instruction but is carried on by the pupil at his home under the supervision of the agricultural instructor. The next 10 years are certain to witness a marked development and extension of the home project method in agricultural teaching in high schools.

Elementary Schools.— Agricultural instruction in the high schools raises many problems that are difficult of solution but the problem is even more serious in the rural elementary school. There are a number of States in which such instruction is required by law but in a large measure it has failed to function because it has been too bookish. This is chiefly due to the fact that in most States there is no adequate system for the preparation of rural teachers. They are unable to go into the school and utilize the experiences of the country child and the opportunities of the farming community for educational purposes. However, some very good results have been attained in spite of the many difficulties. The consolidation of schools has greatly increased the possibilities of instruction in agriculture for pupils of the upper grades. This is also true of the intermediate schools of agriculture and mechanic arts of New York State; and the junior high schools to be found in the rural communities of Vermont. The latter have had a very marked development since 1915 when provision was made for them by special legislation. (See AGRICULTURAL COLLEGES; AGRICULTURAL EXPERIMENT STATION). Consult Bailey, L. H., 'Cyclopedia of American Agriculture' (New York 1910–11); Carney, M., 'Country Life and the Country School' (Chicago 1912); Bulletins of United States Department of Agriculture and of State Experiment Stations.

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EDUCATION, Catholic. See CATHOLIC EDUCATION IN THE UNITED STATES; CATHOLIC EDUCATION IN CANADA; CATHOLIC CHURCH AND SCIENCE; PARISH SCHOOLS, ETC.

EDUCATION, Commercial, a general system of modern education to prepare youth for commercial pursuits which follows the usage of many European schools and colleges, where the selective courses for pupils on entry are designated as either «commercial» or «classical.» The commercial high schools of the public system of education of the United States are organized with industrial aims to give «a general education of such a nature as best fits youth for commercial pursuits.» Supplemental or higher commercial education is furnished by extended scientific training in university departments, in schools of technology, or in independent trade and business schools and colleges.

About one-third of the pupils in high schools in the United States in 1917 were taking commercial courses. Government reports from 31 cities of 100,000 population and over show that from 10 to 60 per cent of all high school pupils take commercial courses, and that of these Boston and Milwaukee have the largest, and Cincinnati, Cleveland, Columbus and Dayton have the lowest per cent. There were special high schools in 1916 in Boston, Cleveland, Columbus, New York, Portland (Ore.), San Francisco, Springfield, Syracuse, Washington and Worcester. The pupils who receive special commercial instruction in the government high schools, and even in the special commercial high schools, continue the study of related academic work with the other pupils from which they are not separated; for commercial instruction is looked upon as general education and is treated as such. While the private business schools have had very definite, if narrow aims, to which they have adhered strictly and logically, the commercial education of the government secondary schools has been more or less a concession to the demands of business interests and practical life; and of late educators have begun to insist that the commercial education of government institutions should be better organized and that its aim be more definitely stated. At present (1918) pupils taking commercial courses in secondary schools give only about 25 per cent of their time to technical commercial education. Another 25 per cent is devoted to «related work» and 50 per cent to «general culture.» The private business schools, on the other hand, go direct to the goal they have set for themselves. The result is that they cover, in from six months to one year, the same commercial work that the secondary schools require from two to four years to accomplish; and the pupils of the private business colleges are taught in a more exact

and businesslike way. Hence the popularity of the latter, though they charge comparatively high fees. In other words, commercial education in the government schools has not yet become individualized, as it has in Germany, where it has developed into a system by itself and not a comparatively unimportant part of a general system, as it still is in the United States. Hence the need of a general reorganization of commercial education along pedagogic and practical lines; for the necessities of business life continue, from year to year, to make more imperative and extensive demands upon the public school system. Owing to the fact that commercial education forms a part of the ordinary school curriculum of secondary importance, most public schools are poorly equipped as to organization and the other machinery necessary to meet the ever-increasing demands made upon them by the business world, which is still pinning its faith to the private business college, which to exist has to keep its ear close to the ground.

The commercial courses of the government secondary schools may be divided as follows: General office work and bookkeeping; stenography, typewriting and the operation of office appliances; secretarial work, which requires more careful training and higher academic requirements on the part of the pupils; and salesmanship. The program of the commercial education of the secondary schools is theoretically good; but in practice it has a decided tendency to be too technical at the expense of accuracy and practicability. On the other hand the private business schools aim, above all things, at speed, accuracy and practical results, and trouble themselves very little over questions of a technical nature, when they are not absolutely necessary to the end in view. The demand being made upon secondary schools is, therefore, that they study more carefully the needs of commercial life and that they impart more intensive instruction and practice in each individual section of commercial education so that their pupils may be enabled to step from the schools into subordinate positions in business concerns. To this end it is necessary to increase and improve the office appliance departments of the secondary schools and to place them in the hands of trained practical teachers, as the better class of business colleges have already done.

Commercial high schools in the United States are confined, for the most part, to the larger cities. They differ very little except in name and the number of pupils taking commercial courses, from the ordinary secondary school with attached commercial courses. Not one of them is primarily a commercial school whose aim is, first and foremost, the teaching of commercial subjects and the preparation of pupils for business life. Even in these schools the equipment of other departments is generally favored at the expense of the commercial. In other words, the commercial education of the United States secondary schools has no traditions to live up to and no definite aims to assure definite results. Until these are attained it must continue to live on sufferance, with other branches of education which have traditions and aims. But little improvement can be hoped for in the teaching of commercial subjects in the government schools until such time as the ordinary high school and the commercial school are divorced and the latter is allowed to follow its own life and maintain a teaching staff trained to keep the needs of commercial education constantly in view.

Students.— There were, in 1917, approximately half a million students in commercial courses in the United States. The Bureau of Education had the names of more than 1,300 independent commercial and business schools, exclusive of the hundreds of other business schools forming departments of normal schools, private schools and other institutions. Only 843 of the independent business schools in 1916 responded to the request of the Bureau of Education for statistical information. The reports thus furnished show that there were in the 843 business schools reporting 183,286 students, an increase of 15,223 over the preceding year. The reports of 762 private high schools show that they had, in 1916, 17,706 students in business courses. The 2,863 public high schools of the country, during the same period, had 208,605 students in their commercial departments. Of the pupils reported in the private business schools 130,431 were in day and 52,855 in night courses. The total number of students reported to the department as in commercial courses was made up as follows:

	Number	Males	Females	Total
Private high schools..	762	9,360	8,346	17,706
Public high schools...	2,863	92,226	116,379	208,605
Commercial schools..	843	94,870	88,416	183,286
Total.....	4,468	196,456	213,141	409,597

Thus it will be seen that the hundreds of business colleges and other institutions having commercial courses, but not reporting them to the department, should easily have increased the number of students in commercial courses to 500,000 in 1917, when the demands of the war had given an added impulse to this ever-growing department of education. Massachusetts led with the highest number of pupils in the public high schools, 28,489, New York coming second with 27,887; but as the latter had more students than the former in private high schools and academies, the total of students of commercial courses, exclusive of the regular private business colleges, was New York, 29,563; Massachusetts, 29,485. Pennsylvania reported 17,544 commercial students in the public high schools, and 2,539 in private high schools and academies, a total of 20,083; Illinois, 13,923 in public high schools, and 1,349 in private high schools and academies, total 15,272; New Jersey, 12,444 in public high schools, and 319 in private high schools and academies, total 12,763; California, 11,567 in public high schools, and 582 in private high schools and academies, total 12,149; Ohio, 10,191 in public high schools, and 995 in private high schools and academies, total 11,086. Michigan and Wisconsin had each about 8,000 commercial high school students; Connecticut about 7,000; Indiana, Minnesota, Iowa, Missouri and Washington between 5,000 and 6,000; Maine, Rhode Island and Kansas between 3,000 and 4,000; New Hampshire, Nebraska, Maryland, Texas, Colorado, Tennessee and Oregon between 2,000 and 3,000; while Vermont, Virginia, West Virginia, Georgia, Kentucky, Louisiana, Oklahoma, Montana, Utah and the District of Columbia had each over 1,000.

The trend of business education in the public schools is shown by the reports of the Bureau of Education for sections of the country as follows: In the North Atlantic States, in 1915, 1,066 high schools are reported as having 109,298 commercial students; the North Central States, 1,424 schools and 70,406 students; Western States, 564 schools and 26,690 students; South Central States, 315 schools and 10,551 students; and the South Atlantic States, 256 schools and 9,369 pupils.

In 1916 there were 54,871 students and 1,511 teachers in the 241 private commercial schools of the North Atlantic States; 76,709 pupils and 1,664 teachers in the 344 schools of the North Central States; 22,926 pupils and 530 teachers in the 110 schools of the Western States; 16,515 pupils and 318 teachers in the 84 schools of the South Central States; and 12,265 students and 286 teachers in the 64 schools of the South Atlantic States. The total number of students reported taking commercial course in public and private high schools and business colleges, in 1915, was: North Atlantic States, 164,169; North Central States, 147,115; Western States, 49,616; South Central States, 27,066; South Atlantic States, 21,631. Everywhere, except in the North Atlantic and Western States, the private business schools were turning out more commercial students than the government institutions. The 843 private business colleges and schools reported to the government as in their employ 4,309 teachers in 1916.

In the fiscal year 1914–15, 19,019 students graduated in commercial courses; 27,826 in amanuensis courses; 14,588 in combined courses; 1,729 in English courses; and 980 in telegraphy.

Higher Commercial Education.— In 1915 there were over 10,000 students studying commerce in the colleges and universities of the United States. At the head of these was New York University with 2,260 students. The University of Pennsylvania had 916 students of commercial subjects; North Western University, 790; University of Wisconsin, 484; University of Illinois, 423; Boston University, 378; University of California, 320; University of Chicago, 220; University of Pittsburgh, 213; and Saint John's, Ohio, 207. In all 60 colleges and universities were reported as having instruction in commercial education; and of these 25 had 100 or more pupils each.

By the middle of the last century, owing to the vast increase of business throughout the civilized world, business men had already come to feel the need of special technical commercial education for their employees. As early as 1855 Gustav von Mevissen, the great European financier, in a report to the Chamber of Commerce of Cologne, advocated the higher education of business men with the surplus capital of the commercial world. But though the business men of Europe felt the need of business education for their employees they struggled vainly against the traditions of the schools, colleges and universities; and it was in the New World that the business college first came, in a measure, to supply the needed business education. But it was not until the universities turned their attention to this field that the dream of von Mevissen might be said to be in a fair way to become realized. He himself began the good work by founding a commercial college at Cologne. But the real pioneer in higher commercial education was the University of Pennsylvania which in 1881 established the "Wharton School of Finance and Commerce." Seventeen years later the University of California founded a similar course leading to the degree of B.S. And in the same year the University of Chicago also added a commercial department with the degree of B.Ph. In 1900, New York University, and in the following year, Columbia University, and in 1902, the universities of Illinois, Indiana and Michigan established commercial courses with the bachelor's degree. Now (1918) most of the important universities of the United States have more or less complete commercial departments. The Harvard Graduate School of Business Adminstration, established in 1908, and the Amos Tuck School of Administration and Finance, opened in 1900, in connection with Dartmouth College, go further in this respect than the other universities, admitting to their courses only college and university graduates whom they train for business and public affairs.

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EDUCATION, Compulsory. The doctrine of the democracy of Calvinism from the beginning of its teachings contained the fundamental principle that each person should be able to read. Under that doctrine religious matters were held to be of vital concern to every person as well as to the nation and each individual was held to be personally accountable for his own conduct. The Bible contained the rules of conduct which should regulate the lives of all people. Each person was, therefore, expected to be able to read that book and not to be dependent upon others for a knowledge of its teachings and of the personal obligations which such teachings imposed. In the countries, therefore, which were under the control of the Calvinists, the basic principles of compulsory education laws, so general in all the progressive countries of the world at the present time, were first established. The general feeling of the people in the Netherlands in relation to education was such that for more than 150 years before the Dutch began to make settlements in America public schools had been maintained in that country. The education of the masses through these schools which were public schools had been the bulwark of the

liberties of the people and the national freedom of the country. The country was prosperous and happiness prevailed among its people. When the Calvinists settled in America they brought with them the spirit and life of the social institutions of their native country and wherever the Dutch settled in America they established schools which were of the type of the schools in the fatherland. These schools were administered on the same general plan on which the schools of Holland had been operated. All children were required to receive instruction. This instruction was provided by members of the family at the home in many cases, often at private schools but generally in the schools established by the authorities of the company who were responsible for the regulation of the affairs of the settlement. The West India Company which made settlements at Manhattan and at Albany adopted an ordinance in 1629 providing that all colonists "shall endeavor to find out ways and means whereby they may supply a minister and a schoolmaster." Under this ordinance, schools were maintained and children were required to attend them. The Dutch, therefore, during their period of control in the colonies planted the germ of the foundation on which compulsory attendance laws are based.

The General Court of the Massachusetts colony issued a decree in 1642 which has also exercised an important bearing upon the development of compulsory attendance statutes. The decree of the Massachusetts court and the preamble upon which it is predicated were as follows:

"Forasmuch as the good Education of Children is of Singular behoofe and benefit to any Commonwealth, and whereas many Parents and Masters are too indulgent and negligent of their duty in that kind;

"It is Ordered, that the Select men of every Town, in the several Precincts and quarters where they dwell, shall have a vigilant eye over their brethren and neighbours, to see, First that none of them shall suffer so much Barbarism in any of their families, as not to endeavor to teach, by themselves or others, their Children and Apprentices, so much learning, as may enable them perfectly to read the English tongue, and knowledge of the Capital Lawes; upon penalty of *twenty shillings* for each neglect therein."

This law did not specify where the children were to be instructed and such law was amended in 1647 by specifically providing that in each township containing 50 families an instructor should be employed to teach all children to read and to write, and the law further provided that in a township containing 100 families, a grammar school should be maintained and masters employed who were able to fit young people for entrance to a university.

Thus, there were in the very beginning of the establishment of organized society in this country two great forces, one Dutch, and the other, English, in different sections of the country, which enacted decrees or statutes which are the basis upon which compulsory education laws of the several States have been established.

When the Republic was founded, no provision was made for a national system of education. Education, therefore, became a subject which was controlled and administered by the several States. It took a long period of time for the development of public opinion which required the establishment and maintenance of public schools. When school systems were established in a State under general laws, and when independent schools were organized under special acts in various communities, provisions were not generally incorporated in such laws or acts which made attendance upon school compulsory. The parent of a child generally assumed that the education of such child was a matter entirely personal with such parent. During the early years of the nation there was a common feeling which was repugnant to all mandatory statutes. The opposition to the enactment of such laws must not be regarded as a lack of interest in public education. The leaders of the nation had an appreciation of the value of education and the national necessity for its promotion and development.

The economic and industrial conditions of the country were passing through a stage of development which influenced the whole social organization of the state. The cities were increasing in population. The number of cities and large villages were also increasing. The industrial and commercial affairs of the country were expanding and developing. Children were being employed in the industries. The increase in immigration was bringing large numbers of foreigners into the country. Young children under the apprentice system were bound out to labor which deprived them of school privileges. These conditions prevailed quite generally in the New England and Middle States. Great evils grew out of these conditions. Hardships were imposed upon children of tender ages. These conditions could be remedied through legislation only. The first effort along this line appears to have been in Connecticut in 1813 when a law was enacted providing that all children employed in factories should be taught reading, writing and arithmetic. In 1836 Massachusetts enacted a law prohibiting the employment of children under the age of 15 in manufacturing establishments unless they should have attended a public or private school for at least three of the 12 months during the year preceding such employment. The law did not place adequate responsibility upon parents, the period of instruction was too short and the penalty of a fine of $50 imposed upon owners, agents or superintendents of factories was ineffective, as no provision was incorporated in the statute defining who should prosecute violations of the law.

The statutes of Connecticut and Massachusetts were undoubtedly modeled somewhat after the English factory laws. Laws regulating the employing of children in factories and providing for the education of children thus employed were enacted in England in 1802 and in 1833. Under the first act all apprentices in the cotton and woollen mills were required to be taught reading, writing and arithmetic "or either of them" during the first four years of their apprenticeship upon every working day and during the hours of work. The employer was required to provide the teacher. In the provision of this act is the germ of the modern continuation school. The act of 1833 greatly strengthened this law. It provided for factory inspectors to enforce the provisions of the act. The employment of children under nine years of age was prohibited. Children between 9 and 13 years of age were required to attend school two hours each day for six days each week. The parent possessed the right to select the school. If the parent failed to make such selec-

tion the factory inspector made it. Parents who violated the law were subject to a fine of 20 shillings. Employers who violated such law were subject to a fine as high as £20. In this legislation of Connecticut and Massachusetts the right of the State to require a child to attend school, to compel the employer of a child to provide educational facilities for such child and to penalize a parent or the employer of a child for failing to provide a child with educational facilities is first asserted in this country. These laws were not general compulsory educaton statutes but they were a step in that direction.

The next important legislation in this country bearing upon compulsory education were the truancy laws of Massachusetts enacted in 1850 and 1852 and of New York in 1853. The Massachusetts Act of 1850 conferred power upon the cities and towns of the State to prescribe ordinances to provide for the education of children who were habitual truants or who were not attending school and who were not employed in regular or lawful occupation. The law applied to children between the ages of 6 and 15. The statute was indefinite and cumbersome. The general purpose was to compel children who were not receiving instruction and who were not employed in accordance with the provisions of the factory laws to attend school. The ineffectiveness of the law was recognized and in 1852 a broader and more effective law was enacted. Under the provision of the act of 1852 certain definite provisions were made mandatory. Parents were made responsible for the education of their children. All children between the ages of 8 and 14 were required to attend some public school in the town for at least 12 weeks and 6 of these must be consecutive. A penalty of $20 was prescribed for violation of the law. The statute, however, contained one clause which expressed conditions under which a person who had not complied with the law should not be regarded as having violated it. Children who were "otherwise furnished with the means of education for a like period of time" were regarded as having complied with the terms of the law. Attendance upon private or parochial schools for the required period of time was held to be a compliance with the law. It was not required that the instruction should be the equivalent and as thorough as that given in the public schools. The burden of enforcing the penalty for violating the law was placed upon town treasurers, and these officers generally refrained from making prosecutions. The New York Act of 1853 followed somewhat the lines of the Massachusetts law. It provided that "if any child between the ages of 5 and 14 years, having sufficient bodily health and mental capacity to attend a public school, shall be found wandering in the streets or lanes of any city or incorporated village, idle and truant, without any lawful occupation," such child and its parents were required to be brought before a magistrate for examination. The court possessed the power to put a parent under written obligation to cause such child to be sent to school for four months. Provision was also made in the Massachusetts and the New York law for the commitment of truants in suitable institutions. These laws were written upon the theory that children who were not truants did attend school and that it was necessary to enact laws relating to the attendance of those children only who were truants. The experience of the States which first enacted truancy laws was that it was difficult to enforce such statutes because of defective machinery provided for their administration. These defects were gradually remedied and the laws gradually strengthened. The experience of the country also showed that laws aimed solely at truancy could not be effectively enforced. This experience further showed that a statute on this subject to be made effective must be a clean-cut law requiring every child within certain ages to attend upon instruction for a definite period of time.

The only American States which enacted a compulsory education law previous to the Civil War were Massachusetts and New York. In 1874 New York substituted an entirely new act for the act of 1853. This law was not denominated a law relating to school attendance or to truancy but it was given the following significant title, "An act to secure to children the benefits of elementary education." It was mandatory in its terms. It required every parent and every guardian of a child between 8 and 14 years of age to require such child to attend school or receive instruction at home for 14 weeks each year and 8 weeks of this attendance must be consecutive. The law specified spelling, reading, writing, English grammar, geography and arithmetic as the subjects in which the children should receive instruction. Children were exempt from the provisions of the law for physical or mental unfitness. The law contained the required restrictions with penalties to prevent the employment of children in labor who had not received the instruction required thereunder. The act contained all the necessary provisions to make it effective except one and this one defective feature resulted in the act not being enforced. That one defect was the conferment of duties in the collection of fines for the enforcement of the law upon city treasurers and supervisors of towns. These officers were elected annually by the people and they were unwilling to incur the displeasure of their constituents and neighbors by the performance of a disagreeable duty in no way logically associated with the functions of the offices to which they had been elected.

The general trend of the development of public education in the United States, the settled policy in America that public education is a State function and that public policy requires the maintenance of public schools, the extension of public school work so as to include modern high school courses, and the further action of the several States in making these educational facilities free to every child in the land, inevitably meant that the authority of the State would be exercised to compel all children to attend school. If the welfare of society and the State depends upon an educated citizenship and if the State possesses the legal authority to tax the property of all its citizens for the accomplishment of this result, then the State must also possess and must exercise the authority to compel the children who are to become its future citizens and upon whom its welfare in the future depends to attend upon the instruction provided for them.

Following the Civil War, which had exer-

cised a liberal influence upon the country, there was a general development of educational systems in the several States on the principles above outlined. In this same period there was a great increase in the immigration of foreigners and there was a large development in manufacturing and industrial affairs. The use of the unskilled labor of children had grown to an alarming extent. These conditions created social and economic problems of vital importance. There was a general demand for more stringent laws regulating the employment of children and providing for their education. Labor unions which were honestly endeavoring to improve social conditions and to give to labor the protection and dignity to which it is entitled gave cordial support to measures intended to correct the evils growing out of these conditions. State and National conferences under the direction of labor commissioners and factory inspectors dealt courageously and effectively with the problem. The enforcement of child labor laws and truancy acts in certain States had the effect of driving families from these States to the States where such laws had not been enacted. The social and economic living standards were being lowered and this condition gradually became understood by the public generally. This fact became an effective agency which enabled society to cope with the ignorant and unscrupulous parent willing to impose improper burdens and even hardships upon his children for financial profit and with the greedy employer who was anxious to avail himself of the cheap labor obtainable through the employment of children. Thus we find that immigration, labor and the industries have been important factors in procuring the enactment of compulsory education laws.

The ordinance of the West India Company in New York in 1629, the decree of the General Court of Massachusetts in 1642, the enactment of the truancy laws of Massachusetts in 1850 and 1852 and the enactment of a similar law in New York in 1853, the amendments to the Massachusetts law in 1867 and 1873 and the new act in New York in 1874 show that these two States assumed the leadership in the attempt to enforce school attendance in America. The statutes of these States have been the models upon which attendance laws in the other States of the Union have been constructed.

There is now an effective compulsory attendance law upon the statute books of every State in the Union except Mississippi, and in Mississippi a compulsory attendance law, permissive in character, was enacted in 1918. The law confers upon the school authorities of any county in that State power to enforce compulsory attendance. The large number of illiterates in the country and the social and economic conditions existing because of the lack of these laws and of proper child labor laws aroused the public conscience and enabled the leaders of the nation who espoused social reforms to obtain the enactment of these laws. It was not, however, until within the last quarter of a century that these laws were made effective or were properly enforced. The official action of Governor Pattison of Pennsylvania in 1891 and in 1893 illustrates to some extent the public feeling toward laws of this type. In those years he vetoed compulsory attendance measures upon the ground that they were un-American in principle and interfered with the personal liberties of the parent. The effect of the enactment of compulsory education laws in the American States has been to reduce rapidly and materially the number of illiterates in these States.

Compulsory attendance laws have generally been enacted in most of the Latin states of North America and in Central America but they have not been enforced. Such laws are practically dead letters in those countries.

England, Ireland, Scotland, France, Switzerland and the Netherlands have effective compulsory attendance laws, and they are generally well enforced in these countries. The compulsory ages are from five or six years of age to 13 or 14 years of age. Japan is the only country in Asia which has a compulsory education statute and such law applies to children between the ages of 6 and 12. While Italy has a compulsory education law its provisions are not enforced. This is also true of Turkey.

The Balkan states have each declared elementary education compulsory and some progress had been made previous to the outbreak of the War in their enforcement.

The number of illiterates in a country indicates to some degree the effectiveness of its compulsory education laws. In the countries having a military system requiring service from all men there will be found few illiterates. In these countries, however, an illiterate is given special instruction before he enters upon his military service. The mandatory features of the military training laws therefore are in effect compulsory education provisions.

The latest available statistics of certain European countries enforcing compulsory school attendance show the percentage of illiterates in the population of these countries to be as follows: German Empire, .03; Denmark, .2; Sweden, .3; Switzerland, .5; Netherlands, 1.4; Great Britain, 1.5; France, 2.97. On the other hand, the latest statistics available also show that in those countries not enforcing compulsory school attendance there are large percentages of the population who are illiterate. The percentage of illiterates of the whole population in such countries is as follows: Russia, 70; Spain, 59; Italy, 48; Hungary, 40; Austria, 26. The percentage of the population of certain European countries which are enrolled in the elementary schools is as follows: Russia, 2.5; France, 14.24; Great Britain, 16; Germany, 16.87. The general result in the European countries and in the American States has been that the adoption of an effective compulsory education law has greatly increased school attendance and rapidly reduced the number of illiterates.

Compulsory attendance laws have been in operation in Prussia for more than two centuries. Such laws and child labor laws have been more effectively enforced in all parts of the German Empire than in any other country in the world. Frederick the Great's general law of 1763 clearly asserts the principle of compulsory education. The law of 1794 reduces the terms of such statute to two very

simple provisions: First, "Every inhabitant who cannot or who will not provide the necessary instruction for his children in his own household is required to send them to school after completion of the fifth year." Second, "The school instruction must be continued until a child in the discretion of his spiritual guide, has obtained the knowledge necessary for an intelligent person of his station in life." The authority to determine the amount of instruction which a child shall receive was transferred in 1872 from the "spiritual guide" to the "school inspector." In some of the German states the attendance of children upon school is controlled by regulation and not statute enactment. The Prussian Act of 1891 and the acts and regulations of the other German states, in relation to compulsory education and to child labor, are stringent measures and are rigidly enforced. There are practically no illiterates in Germany, and in many of the leading cities of that country the number of persons who do not complete the eight-year-elementary course of instruction is less than one-half of 1 per cent. The largest percentage of the population of the people in any country in the world which is in attendance upon school is in Germany.

There are two modern movements in connection with compulsory education statutes. These are for enforced attendance upon continuation schools and enforced attendance of adult illiterates upon evening or other schools. The forces most active in support of these schools are the mercantile and factory associations and organized labor. In many cases the large industrial and mercantile establishments have maintained continuation schools at their own expense for the education of their employees. In many of the German states and of the cantons of Switzerland, attendance upon continuation schools is compulsory for boys between the ages of 14 and 18, and for girls between the ages of 14 and 15.

The English education bill before Parliament seeks to establish compulsory attendance for all young persons under the age of 18. It provides for an increase in the number of secondary schools and for the establishment of part-time secondary schools. It provides that children between the ages of 14 and 18 shall not be employed in the industries unless they have attended a full-time secondary school until they become 17 years of age, or unless they attend a part-time secondary school for not less than nine hours per week.

There has been such a large increase in the number of adult illiterates in this country and the total number of such illiterates has assumed such proportions that there has been much public agitation for the enactment of a compulsory education law which will apply to these illiterates. There are more than 3,000,000 adult white illiterates in the country. Of course, the Congressional act of 1917 which prohibits illiterate immigrants from coming to this country has modified this proposition somewhat. The problem now is to educate the 3,000,000 adult illiterates which are in the country. Massachusetts has a law which compels all illiterate minors to attend upon instruction if they have not a knowledge of English sufficient to admit them to the fifth grade of a public school. New Jersey also has taken advanced action on this subject. The most recent action, however, is the mandatory statutes enacted by the legislature of New York in 1918. Under this law, all illiterate minors are compelled to attend upon instruction. Penalties run against minors' parents and employers who do not conform to the provisions of the law.

The experience of America as well as the experience of the European countries shows that a compulsory attendance law to be effective and accomplish the results sought must contain the following provisions:

1. The law must be supervised by the State educational authorities. These authorities must be given broad powers in the disciplining of local officers who fail to perform their duties.

2. Each local administrative school unit must be charged with the responsibility of enforcing the law and with the authority to appoint and remove attendance officers. The local administration must be under the general direction of the school authorities and not the municipal authorities.

3. There must be a registration of all children above four years of age. The addresses of these children must also be recorded. School authorities must know the number of children becoming of school age each year, so as to make provision for their entrance in school. This registration must be constantly revised so that there shall be at all times an accurate record of the names, ages, addresses and parents of children within compulsory ages.

4. The attendance of children within the prescribed ages must be rigidly insisted upon. A child must be compelled to account for a single day's absence. Physical disability or some other reason equally satisfactory should be the only excuse for an absent pupil.

5. Attendance should be required from the time the child becomes of school age until the child has completed in a satisfactory manner the prescribed elementary school course.

6. Provision should be made for attendance upon co-operative continuation schools for a period of at least two years beyond the completion of the elementary course.

7. Provision should be made for the imposition of fines upon parents or guardians who fail to respect the law.

8. A city, town or school district which fails to enforce the law satisfactorily should be refused grants of State funds until said law is properly enforced.

9. Attendance laws should be operative during the entire period in which a public school is in session in a city or other local administrative unit.

10. These laws must contain restrictive provisions in relation to employment of children within compulsory ages in mercantile, manufacturing and other occupations.

11. In America, instruction in English in the entire curriculum for the compulsory attendance period should be mandatory, and the subjects in which instruction is required should be specified.

12. When instruction is given a child within compulsory ages at home or in a private or parochial school, such instruction must be substantially the equivalent of that given in the public school and by qualified teachers.

13. Attendance officers and other representatives of the school authorities must be given the right to enter shops, factories and other industrial and commercial places, to ascertain full information in relation to the employment of children, to determine whether or not employers violate the attendance and labor laws.

14. Provision should also be incorporated in such laws requiring all adults who are unable to speak and write the English language to attend evening or other schools until they have acquired such attainments.

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EDUCATION, Courses of Study in. The course of study which forms the outline of work in the best schools of to-day is a broad, socialized program, having little resemblance to the brief course in the schools of 50 years ago. Reading, writing and arithmetic were then the subjects of instruction covered in the elementary schools. In the "academies" Latin and Greek were the principal subjects with some mathematics, as the purpose of the instruction was preparation for college. In many States there are now certain statutory requirements relative to the course of study such as the teaching of physiology and hygiene and instruction in reading, writing, spelling, arithmetic, geography and history. The emphasis to be given to these different subjects, the assignment of time allotments, and the teaching of other subjects such as music, drawing or science are fixed largely by local superintendents and boards of education.

During recent years courses of study have been "enriched" and "vitalized" by the introduction of many new subjects. Some have held that too much new matter has been added with the result that thorough work is no longer possible. On the other hand, the vast changes in the social and economic life of the day demand a closer relation between the program of studies and the immediate daily life of the child. The scientific study of the progress of pupils has established the fact that there has been considerable waste in useless repetition in the elementary grades. The activities which have been introduced through play and games, story-telling, dramatization, handwork, weaving, sewing, cooking, wood-working, modeling, gardening and other means have been added largely because of their interest. They were considered helpful devices in the monotony of the daily routine. Only recently has their social value been appreciated. The recognition of the importance of these activities in the growth and development of the child has given them a definite place in the course of study. The evidence of waste in effort and of undue time allotments for the fundamental subjects makes the articulation of the new work more easily accomplished. The schools are an important part of the social life of the community, not apart from it. In the process of education the course of study must present in rational sequence type forms of life experiences. The vast changes in our social conditions have reacted on the whole theory and practice of education. Courses of study are, therefore, not definite and final, but subject to constant modification. Health education was not thought of yesterday, but is all-important to-day. Physical training, supervised playgrounds and recreational centres are provided in the educational program of every progressive community. The school day is being lengthened, and the time is not far distant when the course of instruction will be continuous throughout the year.

Too often this enrichment has resulted in mere multiplicity of subjects and congestion of the program. It should not mean this if the entire course is unified and the common aims of the instruction determined. The study of the relative values of the different subjects of instruction and the elimination of useless material has resulted in the consensus of educational leaders that six years is ample time in the elementary grades to be given to the study of the so-called common branches. At least it is thought that the problem in the first six years has been too much a mere pouring in process to give the child a vast accumulation of facts; that he should master the fundamental processes of reading, writing and arithmetic, and form a proper mental attitude toward his social environment.

The thought has been held for several years that many of the so-called secondary subjects should be begun before the ninth year. The several reports on this subject which appeared around 1900 emphasized the unreasonable rigidity of the system which fixed eight years for the elementary course and four years for the secondary course. These discussions largely centred on the necessity of economy of time and a more thorough instruction in subject matter. The epoch-making treatment of the subject of adolescence by Hall was a new and compelling factor in the consideration of the reorganization of the course of study. It became clear that the psychological break came too late; that the eight and four plan for the elementary and secondary school work was illogical as well as uneconomical; that the development of the youth, physically as well as psychologically, demanded the reorganization of the school work on the six and six or the six-three-three plan, by which some differentiation in the course of study and methods of instruction might be made after the sixth school year. The great elimination of pupils in the seventh and eighth grades and the failure of the course of study to function compelled remedial action. Hall's complete discussion of adolescence and Dewey's emphasis on the relation between the course of study and the social environment have resulted indirectly, if not directly, in the development of the intermediate school, covering the seventh, eighth and ninth years. In the six-three-three plan the elementary work is followed by a three-years' intermediate course, and that in turn by the secondary course of three years. The course of study in the intermediate school, or junior high school as it is sometimes called, is to assist the boys and girls to find themselves; the work is slightly differentiated into groups to meet individual needs and to give an acquaintance with the first principles of a few fundamental occupations. The work is departmental and promotions are made by subjects. The courses are in a sense prevocational in that the pupil has the opportunity to test his inclinations and capacity through the socialized grouping and co-ordination of

subjects. He is given more freedom than in the elementary school but is not left on his own resources as in the secondary schools. The organization of the intermediate school with the development of the course of study best suited to the peculiar needs of the pupil in his relation to his social environment is only a step in the solution of a large educational problem; it is far from being solved.

In the secondary field courses of study are still largely dominated by the college idea. The college preparatory aim persists not only in the course of study but in the treatment of separate subjects of instruction. In very few of the courses of study in the secondary schools has there been any complete correlation of work or definite aim. The subjects are too often unrelated to each other and bear little relation to the social environment. The mortality in the secondary schools is very high, as only 20 to 25 per cent of first year pupils complete the course. While no one factor is responsible for this condition, the failure of the course of study to function has been a determining element.

School courses have been planned for the graduate, not for the pupil who goes part way through, notwithstanding the fact that the great majority do not complete the course. The aim of the eight-year elementary course has been the completion of the requirement for "admission to high school." The aim of the high school course has been the "college" or professional school requirement. The needs of scarcely 5 per cent of secondary pupils have determined the course of study for the other 95 per cent. The relation of the school work to the social environment has been almost entirely overlooked in both the general outlines of courses of study and in the method of treatment of the subjects of instruction.

The solution seems to be in the shortening of the elementary course and in the modification of the work in the seventh, eighth and ninth grades, or intermediate school, so that a slight differentiation in work may begin before the adolescent period, and that the secondary course of three years furnish opportunities for the development of the different types of individual pupils. Each course should be based on definite needs and have a definite and specific aim. It should furnish the pupil the opportunity to carry forward the particular work in which he showed or developed interest in the intermediate school.

The more logical break which comes at the end of the three-year period at the close of the intermediate courses does not leave the pupil wandering aimlessly. He has been given an opportunity to find his bent. The diversified course of study in the intermediate school holds the pupil much better, and even if he should leave school at the end of this period, he has had the advantage of an additional year beyond the eight grades, with a course of instruction planned to meet his needs.

A reconstruction of the secondary course is under way. In part the needs of pupils are being met through the organization of technical high schools, commercial high schools, vocational and continuation schools, and in some high schools special courses in technical, commercial or vocational subjects are offered along with the so-called academic work. There are two schools of thought with regard to the vocational courses; one, that there should be set up an independent educational organization for this vocational work, and the other that such a program is undemocratic, that the courses in vocational, technical and academic subjects should be carried along side by side with no separate educational administrative organization.

This adjustment with the environment is being worked out and courses are being evolved with definite social aims. There will be no fixed courses of study, as they will always be subject to modification as the needs change. There will be no final differentiation between academic and vocational, as technical or cultural training will depend upon the needs of the pupil rather than on any mere arbitrary classification of studies. Courses of study must be adjusted with the whole environment in terms of individual and community needs.

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EDUCATION, the Development of the Office of School Superintendent. Supervision of schools by educational experts is an American idea. In ancient Athens, it is true, the teachers were to some extent under the supervision of the State. Overseers were appointed to enforce the laws respecting morality. The State, however, exercised but little supervision over the qualifications of tutors or their methods of teaching. Charlemagne visited the school of the palace and placed the schools for the education of the clergy under the care of the bishops and the parish schools under the care of the priests. They had so many other duties that they could not exercise a close oversight over the teaching in the schools which were thus placed under their care. Luther and Melanchthon visited schools and churches under the direction of the Elector of Saxony, but their time and strength were devoted to duties other than those of supervision. When the king of England and the nobility made liberal subscriptions for the establishment of a system of charity schools, in which the German children of Pennsylvania might be taught English, and thus through the instrumentality of language be attached to the English Crown, Rev. Michael Schlatter was in 1754 made superintendent of those schools at an annual salary of £100. He was succeeded by Dr. William Smith, who was outspoken in his loyalty to the British government. The former was a missionary of the Reformed Church, and the latter was provost of the university. Hence neither of them could devote much time to the work of supervising the schools under their care.

City Supervision.— The idea of appointing a person who was to devote all his time to school supervision first took shape in Buffalo, N. Y., and Louisville, Ky. In the winter of

1836–37 a law was passed by the legislature of New York authorizing the appointment of a superintendent of common schools in Buffalo. R. W. Haskins received notice of his appointment on 10 Jan. 1837. He accepted the office, but finding the law defective, he resigned before the expiration of the year, and was succeeded by Oliver G. Steele, who has always been known as the father of the public schools of Buffalo.

The city of Louisville, Ky., appointed a superintendent of schools in 1837. He was called Agent of the Board of School Visitors and began his work in the month of September. Two years later Saint Louis, Mo., and Providence, R. I., appointed superintendents. The last of the great cities to create the office of superintendent was Philadelphia.

State Administration and Supervision.— New York also led the way at a still earlier date in provisions for State administration and supervision of schools. The law of 1795, which appropriated for school purposes $100,000 each year for five years, provided for the annual election of not less than three, nor more than seven, commissioners in each town who were to supervise and direct the schools. By the act of 1787 the regents were empowered to charter colleges and incorporate academies, and to exercise supervision over them, being authorized and required to visit and inspect them, to examine into the condition of education and discipline in them, and to make an annual report thereof to the legislature.

On 14 Jan. 1813 Gideon Hawley was elected superintendent of common schools of New York and retained the office until 22 Feb. 1821, meanwhile having been appointed secretary of the board of regents, 25 March 1814, and continuing in that capacity until 1841. When he was removed by the "Counsel of Appointment" just prior to the expiration of its own life, as provided by the constitution of 1821, public indignation rose to such a pitch that the legislature promptly abolished the office of superintendent and devolved the duties upon the secretary of state. But the office has been continuous from 1812 to the present time and has been held by several of the most distinguished men of the State.

Maryland had a State superintendent in 1825, and Vermont in 1827, but in neither was the office continuous. In Pennsylvania the duties of State school administration were, in imitation of New York, devolved upon the secretary of the commonwealth, and Thomas H. Burrows achieved lasting fame by his work for the common schools while serving as secretary of the commonwealth. Most of the time, however, the function of school administration was assigned to a clerk or deputy until 1857 when the office became independent of and co-ordinate with the other departments of the State government. Michigan created the office in 1836, and Massachusetts in 1837 with Horace Mann under the title of secretary of the State Board of Education. Kentucky came next (also in 1837), and then Connecticut with Henry Barnard under the same title as that adopted in Massachusetts. His office was abolished in 1842, but resumed by himself in 1849. Since that time the establishment of the office has been rapid, and in the newer States the office dates from the beginning of their organization, either as a Territory or as a State.

County and Local Supervision.— In 1841 New York passed a law for the appointment, by the Board of Supervisors of each county, of a deputy State superintendent of common schools for the county, except that in counties having more than 200 school districts they were to appoint two deputies. These deputies came to be known very soon as county superintendents, and the arrangement lasted until 1847. In 1843 provision was made for the election of town superintendents and this lasted till 1856. In 1854 a State Department of Public Instruction was again established, and the office of superintendent of public instruction was created. In 1904 the Department of Public Instruction and the Board of Regents were consolidated, and at the head was placed a State commissioner of education. The powers lodged in this department of the State government have been surprisingly large. Its decisions cannot be questioned and reviewed in any court or in any other place. Thus school disputes can be settled promptly and without much expense.

In Massachusetts there have been several great epochs in the development of the policy of school supervision. The ordinance of 1647 obliged all towns of a given number of householders to provide and support schools. The law of 1789 authorized the employment of a school committee to look after the schools. In 1826 such oversight was made obligatory by law. The people of Massachusetts have always been jealous of their rights and correspondingly slow to delegate power to persons in office. The high-water mark of democracy and the low-water mark of the Massachusetts school system was reached when prudential committees and district committees began to be in collision or collusion. The law of evolution under which the people gradually demand the best in education for their children brought on the period of supervision by experts. At first school committees appointed one of their own number to inspect the schools. The school committee of Cambridge in 1836 and of Gloucester in 1850 delegated to one of their members certain supervisory duties and designated him superintendent of schools. The first instance of the appointment of a superintendent other than that of a member of the school committee in Massachusetts was in Springfield in 1840. He remained in office but two years. The first permanent appointment of such an official was made in Boston in 1851. The experiment was successful, and in 1854 a law was passed (amended in 1857 and 1860) authorizing towns and city councils to require the school committee to appoint a superintendent who should have the care and supervision of the public schools. The cities and large towns, one after another, adopted the plan until in 1879, 25 years after the permissive bill was passed, 35 cities and towns employed superintendents for full or nearly full time. In 1888 a law was passed permitting the employment of a superintendent by two or more towns, the expense therefor being largelv borne by the State. Permissive measures were followed by mandatory laws, and the legislature of 1900 passed an act obliging the school committees of all towns and cities to employ a superintendent of schools after 1 July 1902, the towns having a valuation of less than $2,500,000 to be governed

by the law under which two or more districts could join in the employment of a superintendent. New York and Massachusetts are typical States, and their example was followed elsewhere, especially in the Northwestern States and in Pennsylvania. In the latter State the office of county superintendent was created in 1854. Popular indignation rose to so high a pitch over the creation of so many new offices that it helped to defeat Governor Bigler when he came up for re-election. But his successor, Governor Pollock, took a bold stand in favor of school supervision, and the superintendent of schools whom he appointed, Henry C. Hickok, made it his chief aim to show the people that they would get more in return for their school taxes if the schools were placed under the supervision of men fitted for the office by literary and professional qualifications. The law in Pennsylvania has always been a schoolmaster of public opinion, and in no long time the advantages of school supervision were recognized, and the policy of electing county superintendents at a convention of school directors specially called for the purpose has been left unchanged although the term has been lengthened to four years. The requirement that the superintendent must possess literary and professional qualifications in order to fill the office has been adopted in other States.

Ohio created the office of county superintendent in 1914. He is elected for a period of from one to three years by a county board of five members who are themselves elected by the presidents of the district boards.

Salary.— The higher compensation which the superintendent receives, as compared with the teachers under him, has raised in the public mind the question: "How does the superintendent earn his salary?" To answer the question the school system may be likened to a manufacturing establishment whose operating expenses exceed the income by $20,000. The deficit caused the stockholders to employ a more efficient superintendent, who by organizing the workmen, rearranging the work and saving the waste or raw material not only prevented this loss but made a profit of $50,000 by the end of the next year. Did the new superintendent earn the $5,000 salary which he received? To ask the question is to answer it. But in school work there is waste far more serious than the waste of raw material. The most valuable asset of a commonwealth is brains, and this goes to waste through inefficient teaching. The time and effort of pupils is too valuable to be wasted during the most plastic period of human life. It is the function of the superintendent so to organize and oversee the work at school that the people may get the largest return for the taxes gathered for educational purposes. The results of school supervision have established in public favor the office of superintendent and the policy of school supervision in every State of the Union.

Duties of the Superintendent.— Various functions are assigned to the superintendent. If he is to be held responsible for the efficiency of the schools he must have a voice in the selection, suspension and dismissal of teachers, the promotion of pupils, the making of the course of study, the selection of the textbooks, the purchase of apparatus and the location, erection, and condemnation of schoolhouses. In smaller towns difficult cases of discipline are referred to him for adjustment; in the cities and larger towns such cases go to the principal who then assumes many of the functions of a supervisor. Where a superintendent's powers are based upon statute it is easy for him to exercise these functions. When he must exercise them through committees the situation becomes very complex and requires the greatest tact and personal force.

Methods of Teaching.— The superintendent is everywhere expected to improve the methods of teaching. Hence he is charged with the duty of conducting teachers' meetings, and in some States he has charge of the annual teachers' institute. He makes reports to the Board of Education, stands between the schools and the newspaper reporter bent on mischief, between the teacher and the unreasonable parent, as well as between the schools and the ill-advised reformer. It is also the duty of the supervisor to protect the child from over-pressure in school work and from other unreasonable demands on the part of the teacher. He may, by ill-advised and too frequent examinations, ruin the methods of teaching and unnecessarily worry the minds of teachers and pupils. It is now recognized that children have rights as well as duties, that one of these rights is the right to be happy at school, that children cannot be happy unless the teachers are happy in their work, and that no teacher can be happy if he or she is constantly annoyed by rude or unreasonable demands from the superintendent. Hence the educational leaders of America have insisted that the superintendent shall be courteous in manner, always pleasant to parents, teachers and pupils and capable of sending them away satisfied, even when he must refuse their requests.

Assistant Supervisors.—Where the administration of schools absorbs most of the time of a superintendent it has become imperative to appoint supervisors who take charge of special lines of work, like drawing, music, manual training, primary instruction. In the selection of these assistants it is important to get experts who can get things done. Mere inspection for the purpose of reporting what is done falls far short of the real purposes of school supervision.

From the nature of the case, county superintendents cannot exercise as close supervision as is possible in cities and towns. Various duties have been assigned to them in different States, namely, to examine teachers, issue certificates, visit schools, conduct the annual institute, make reports to the Department of Public Instruction, see that the schools are kept according to law, that the State school appropriation and other school funds are wisely expended, and that schoolhouses unfit for use are replaced by modern structures. The preparation of questions for the examination of teachers and the employment of talent for the annual institutes has in many States been delegated to the State superintendent and his assistants.

The Selection of Superintendents and Public Opinion.— Of the various plans for the selection of State or county superintendents, that by popular vote is least satisfactory. Nominating conventions are apt to select candidates for geographical reasons or political services and not on the basis of fitness for the duties of the office. This may be prevented by public opinion.

The superintendent has no duty more important than that of creating educational sentiment. The schools cannot be made better than the people want them to be, nor will they be allowed to lag far behind the demands of public opinion. See SCHOOL SUPERVISION.

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EDUCATION, Elementary.— In all the elementary schools of the United States, public and private, there were enrolled in the year 1914 over 19,000,000 pupils,— 17,500,000 of these in public schools. The average number of days attended by each pupil enrolled in the public or common schools and including rural schools was 115.6 days, and the average length of the school term 158.1 days. The total expenditure per pupil was $38.31 for sites, buildings, salaries and all other purposes as compared with $15.91 for the same items in 1875.

Rural Schools.— By the increasing concentration of industrial and commercial life and the concurrent growth of railways and other modes of rapid transportation during the past 50 years, the suburbs of cities were greatly extended, the urban population vastly increased and the rural population diminished. Rural schools suffered correspondingly. Within later years, however, a reaction has set in favor of agricultural life by which rural schools have begun to profit. There still are rural schools in sparsely settled districts that continue the old practice of holding winter schools with limited sessions of 50 to 90 days and taught by ill-prepared makeshift teachers. Yet lingering shortcomings are steadily yielding to the establishment of union schools, to the consequent more generous extension of school terms and to increasingly successful efforts to secure more adequate preparation of prospective teachers through special normal courses in State and county normal schools and in high schools. In the union schools a number of districts are consolidated; the children are conveyed to these at public expense; the courses of instruction are graded; the teachers comparatively well prepared and more permanent. Moreover, they offered rallying points for the people of the community for lectures, entertainments, discussions, exhibitions, institutes, social gatherings, etc. In a number of instances, increased interest in education was stimulated and led to the establishment of township and county high schools. Township high schools are common in New England and in some of the Middle Atlantic and Middle Western States; Kansas and Oklahoma and several of the Middle Western States have county high schools.

Much fresh stimulus, too, has come from the extension and increased stringency of compulsory school attendance laws. Since 1899 such laws have been passed or amended in the direction of greater stringency by all the States save two, and 28 of these require attendance during the full school year for from 6 to 9 years. The beneficial effect of such legislation will appear in the fact that the percentage of illiteracy has sunk from 7.1 per cent in 1900 to 4.1 per cent in 1910. Furthermore, it appears that out of 100 persons enrolled, approximately 92 pursue elementary studies, 6 are enrolled in secondary schools, and 2 are in higher institutions.

From the general character of courses of study, it is fair to assume that the average schooling in all but the most backward rural district is sufficient to secure for each normal person enough to enable the future citizen to read and write and cipher within the practical needs of life, and to enjoy in addition some geographical knowledge, some acquaintance with the history and political organization of his country and, in many instances, some skill in singing, in drawing and other handwork, and a measure of literary taste.

Trained Teachers.— Consideration of the reasons for increasing the length of the term of the elementary school and the adoption of a graded course of study, reveals the most important item of improvement in the recent history of American schools, namely the introduction of professionally trained teachers. The first normal school in the United States was established at Lexington, Mass., in 1839. The number of normal schools supported by state or municipal governments has increased since that year to 235; in addition there are 46 private normal schools and a number of courses for the training of teachers in high schools and colleges. The advantage of professionally educated teachers above others lies in the fact that they have learned to use methods and devices intelligently and in thoughtful adjustment to the needs and interests of children. They have learned to distinguish between the essential and the accessory in the subjects of instruction and know how to lead the pupil to inspiring uses of his knowledge in deliberate research and in successful application to varied purposes of achievement.

But much is yet to be done, if teaching is to become a profession with adequate permanence of tenure on the part of its votaries. Thus, with regard to rural schools, Harold W. Foght, rural school specialist of the United States Bureau of Education, reports that the average rural school teacher remains in the profession less than four years of 140 days each. "This means that the entire personnel must be renewed every four years or that about 92,000 new teachers must be provided annually." Now, the normal schools of the country had enrolled in 1913–14, 94,455 students and graduated only 19,438. The burden of providing for the largest immediate supply of rural teachers falls upon the training departments of high schools and upon county and township training schools in some of the States. Nor do these sources seem to be adequate in view of the fact that in 1913, according to the commissioner's report, there were in the teachers' training courses of public and private high schools only 3,767 boys and 23,284 girls. Nor is the dearth of satisfactorily trained teachers confined to rural schools; for of 1,350 cities reporting to the Bureau of Education in 1914 only 474 require elementary teachers to be normal school graduates, 630 require only a high school education, and the remainder fail to specify what qualifications are demanded.

Probably the most serious obstacle to the professionalizing of teachers is to be found in the comparatively low salaries paid them. In 1914 the average wage of elementary teachers

in cities of 25,000 and less than 50,000 inhabitants was $641; in cities of 5,000 and less than 10,000 inhabitants the average wage was $533; both wholly inadequate to secure normal graduates and continuous tenure. With similar import, the investigations of the National Education Association committee on teachers' salaries discloses the fact that the annual wage of farm laborers in 1913 was $257, while the average wage for rural teachers was but slightly more, although the exact figure was not available. At the same time, the average wage of rural mail carriers was $1,150. The average salary of elementary teachers in cities of 100,000 and fewer than 250,000 population in the same year was $791, and in cities of 5,000 and fewer than 10,000 population the average salary reached only $533.

Under such conditions permanence of tenure and the choice of teaching as a life work become almost unthinkable. One-third of the men and one-half of the women engaged in teaching are under 24 years of age. One-half of the teachers have had but four or fewer years of experience, and one-fourth can claim only one year of experience. At the same time, because of the more varied and wider opportunities for profitable vocational employment, men are more and more turning to other pursuits and leaving the field of teaching to women. Thus it has happened that the percentage of men teachers, which in 1870–71 amounted to 41, has steadily declined so that in 1911–12 it had fallen to 20.9, leaving practically four-fifths of the field to women. Unfortunately, this situation is still further complicated by the fact that, all but universally, married women are excluded from eligibility. Consequently, to the characteristic of the great majority of elementary teachers there has to be added the qualification that they are unmarried women. This qualification each teacher, up to a certain age, hopes to escape, thus adding a new factor to the uncertainty of tenure and a new limitation to the growth of professional spirit.

Sex Problem.— The modern reorganization of the elementary school which will be discussed later on in full, presents among other welcome features the fact that it brings into the life of the child at an earlier period the influence of men teachers. The value of this cannot be overestimated. It furnishes the boy realizable ideals and examples he can emulate, and to the girl it furnishes the opportunity to gain respect for the masculine factors in life on the ground of merit. I direct attention to this without prejudice to the equally valuable influence of women in the school; for I am aware of the fact that the all but exclusive employment of men as teachers in former days had as weakening an influence upon the effectiveness of schools as their excessive feminization has upon the schools of to-day. As in the ideal family we find mother and father, sister and brother, so in the school both elements should be found in vital proportion, if the children are to grow into ideal relationships in a social organization involving both women and men.

Under the circumstances indicated, it is evident that small rural districts cannot secure professionally trained teachers. Such, indeed, find ready employment in cities and villages; for these, too, as a whole cannot show in their graded schools an average of more than one teacher in three that holds the diploma of a normal school.

Urban Schools.— Another great advantage belongs to the schools of the village or city. They are graded schools, have a regular course of study, proper classification of pupils and uniformity of textbooks. In the small district school 15 to 40 pupils are brought together under one teacher. Their ages vary from 4 to 20, and their degree of advancement ranges from beginners to those who have attended for 10 or 12 winters and attempt secondary studies. It still may happen that there is no unformity of textbooks except, perhaps, in the speller and reader, each pupil bringing such arithmetic, geography or grammar as his family may possess. This was the case universally in the old time district school — such as existed in 1790, when 29 out of 30 of the population lived in rural districts, and 50 years later when only 1 in 12 lived in a city. As the railroad has caused villages to grow into cities, so it has virtually moved into the city a vast population living near railway stations in the country by giving them the morning newspaper and rapid transportation. In 1890 one-third of the population was living in cities of not less than 8,000 inhabitants. But the suburban populations made urban by the railroad swell the city population to one-half of the whole nation. Hence the great change now taking place in methods of building schoolhouses and in organizing schools.

With this change in the condition of the population, the method of individual instruction was supplanted by class instruction. The individual did not gain much under the old plan, for the reason that his teacher had only 5 or 10 minutes to examine him on his daily work. In the graded school each teacher has her grade divided into two sections and hears one recite while the other prepares a new lesson. All pupils learn more by such class recitation than by individual recitations, for in the class each can see the lesson reflected in the minds of others, and understand the teacher's views much better when drawn out in the form of a running commentary on the recitation.

Textbook and Oral Teaching.— It is supposed that the chief work of the pupil is the mastery of textbooks containing treatises that give the elements of branches of learning taught. The evil of memorizing words without understanding their meaning or verifying the statements made in the book is incident to this method, and is perhaps the most widely prevalent defect in teaching to be found in the schools of the United States. The oral method escapes this evil almost entirely, but encounters another. The pupils taught by the oral method exclusively are apt to lack power to master the printed page and to get from it the full meaning; they need the teacher to explain technical phrases and definitions. The American method of textbook instruction, it is claimed, throws the children upon the printed page and holds them responsible for its mastery. The pupil is taught to assume a critical attitude toward the statements of the book and to test and verify them or to disprove them by appeal to other authorities or by actual experiment. It is evident that this system of instruction is feasible only in

graded village and city schools and can find no place in the ungraded small rural school. Where such schools have made the attempt to classify their pupils, e.g., in arithmetic or geography, they were obliged to unite in one class children of very different degrees of attainment with unavoidable injury to the dull by overpressure, to the gifted by neglect, and with but doubtful benefit to the average.

The chief objections to this method of work in graded schools has been found in its tendency to degenerate even in the hands of well-equipped teachers into spiritless "machine" work and mass-teaching with their disregard and suppression of individual needs and interests, as well as of the claims of spontaneous social intro-ordination. It proved to be economical financially, it is true, but wasteful educationally. The shortcoming is further emphasized in 24 States by the fact that these have made uniform textbooks mandatory. In some of these States the adopted books must be used as basic texts in all schools, elementary and secondary, and in all districts; in others, high schools are permitted to select for themselves; and in still others, city districts and special tax districts may adopt whatever books they may desire. In a few instances, where the State prints its own texts and modifies them from time to time on the basis of advancing professional insight, possible evils of the measure are greatly mitigated.

A concomitant of the "machine" work and mass-teaching to which large graded schools have been subject is found in so-called discipline or government. The establishment of order, regularity, silence, concerted action and general obedience to authority offered great difficulties and invited measures that seem arbitrary, out of relation with the object in view, and without even indirect appeal to the children's good will and insight.

The New Pedagogy.— However, under the inspirations of Frœbel and Herbart, of Spencer and Wundt, of Dewey and Hall, and many others, a new psychology and a new pedagogy are coming to the rescue. More and more, in the life of the school, the needs of the child with reference to his individual and social development are coming to the front. The treatment of subjects of instruction is learning to adjust itself to these needs; the very textbooks, more especially in elementary schools, reflect the new tendencies, place stress upon touching interest on the basis of the learner's experience, upon stirring the desire for independent research, upon utilizing new knowledge in fresh individual achievement or generous social endeavor. Similarly, disciplinary measures are judged more and more by these considerations. Incentives are adapted to individual nature and need. Encouragement is taking the place of relentless pedantic criticism. Good will, insight and self-respect are appealed to and, in growing proportion, deliberate self-control and even organized pupil-government take the place of ostentatiously vigilant government by teachers.

Much is due in the gradual reorganization of the elementary school to the influence of the kindergarten, of manual training, drawing and certain phases of nature study. In all of these the value of the hand as man's chief organ in exploring his world and in adjusting it to his needs is fully revealed. With their introduction the motto, "learn by doing and in order to do," acquired appreciable meaning. At last, the whole child — hand, head and heart of him — went to school. The liberal and the practical lost their antagonism, became indeed the two indispensable poles of full culture which carries men, as Gœthe has it, "from" the useful, through the true, to the beautiful. The progress of the kindergarten as a factor in elementary education has been quite rapid. The first public school kindergarten was established in Saint Louis in 1873. In 1892 the Commissioner of Education reported 459 public and 852 private kindergartens in the United States. In 1898 there were in 389 cities of 8,000 inhabitants or over 1,365 kindergartens supported by public funds. The number of teachers employed in these was 2,532, and under their care were 95,867 children. At the same time, information had been obtained concerning 2,998 private kindergartens, with 6,405 kindergartners and 93,737 children. Thus the total number of kindergartens, public and private, in this year was 4,363 with 8,937 teachers and 389,604 children. Kindergartens were authorized in 14 States, but a number of cities had established kindergartens through powers conferred in their charters. For 1914 the commissioner reports that in all States but one the establishment and maintenance of kindergartens is either required by law under certain conditions, specially permitted by law, or permitted under general authorizations. There were reported in this year 7,254 public kindergartens in 1,135 cities with an enrollment of 391,143 children. In addition there were reported in 677 cities and villages 1,571 private kindergartens with an enrolment of 74,725 children; yielding for this year a grand total of 8,825 kindergartens with an enrolment of 465,868 children.

It is the general consensus of opinion on the part of superintendents, principals and primary teachers that the kindergarten child has advantages over the non-kindergarten child, other things equal, in good school and life habits, in wealth of ideas and power of expression, in powers of observation and concentration, in perseverance in a task once begun, in control of the hand in manual work, in social co-operation and sense of responsibility in common work, in responsiveness and obedience and a number of other minor points. So beneficial, indeed, has been the influence of the kindergarten upon the spirit and work of the primary school that deliberate movements for the mutual adjustment or even coalescence of the two are becoming more and more urgent. It is proposed — and sporadically carried out — that the transition from one to the other be made less abrupt and that in normal schools student teachers for the kindergarten and others for primary work be taught together in all essential things; in short, that the kindergarten be no longer treated as a separate department, but be made an integral part of primary instruction.

A further development brought to the elementary school by the kindergarten is found in the fact that it directed favorable attention to the value and need of modeling, drawing and other forms of constructive and creative handwork in connection with the educative activities of the school. This prepared the way for slojd and other forms of manual training which later on came to the upper grammar

grades and to secondary schools, largely under the pressure of the growing industrial needs of the country.

Certain of these forms of manual training had been advocated long ago by Locke and Franke, by Rousseau and Pestalozzi; but the recognition of its full value as a factor in education was reserved for Frœbel. He, first, fully and clearly revealed the law that the end of mental activity is not knowledge, but the use of knowledge in some sort of self-expression or doing; that as the acquisition of knowledge rests largely upon the activity of the exploring hand, so the application of knowledge to the needs of life is largely dependent upon the activity of the achieving hand; and, furthermore, that full normal interest in learning can be stimulated only by the achievements it serves. To Frœbel, the manual training he had in mind was not a new subject of instruction, nor was it a concession to the industrial need of the time, but an immanent factor in every part of the educational work, adding meaning to intellectual effort, substance to ethical and esthetic aspiration. In a measure, then, it includes all the workshop and sketching-room, the kitchen and sewing-room features of current manual training departments of the elementary school, but it also includes the manual work of the kindergarten and of the modern primary school, the laboratory, the studio and the schoolgarden. In a broader sense, looking upon the hand as the symbol of deliberate muscular activity, it even may include the new attitude of the school to physical training, to play and playgrounds, to dramatization, to song and rhythmic motion.

Inspiration for manual training of a technical and industrial character came to European countries from Finland and the Scandinavian countries. To Uno Cygnæus, whom his countrymen fondly name "father of the school," belongs the honor of first introducing work of a technical character in the urban schools and slojd in the rural schools of Finland in 1866. Similar and almost simultaneous movements for the extension of slojd and home industries in the schools of the people were carried on successfully in Sweden and Norway and more particularly in Denmark. In our own country, what goes by the specific name of manual training is traced to an exhibit of a Russian institution at the Centennial Exposition in Philadelphia in 1876. The value of the system of manual training, there suggested, appealed to such men as John D. Runkle and C. M. Woodward who introduced it into the institutions under their charge and became forcible advocates of its value. The advanced technical features of this phase of manual training — including various forms of woodwork and ironwork — are confined to high schools and, in some instances, to the upper grades of the grammar schools. The manual training of grades below the 7th deals with extended kindergarten material, with paper and cardboard work, plastic material, raffia, bookbinding, simple forms of slojd, etc.

Industrial Vocational Training.— Within recent years the problem of manual training has been much complicated by movements for the establishment of courses for industrial and vocational training which involve more or less complete preparation for distinct callings, coupled with the opportunity for the pupil to find under so-called vocational guidance what particular vocation or group of vocations it is most profitable for him to choose. While in the original manual training, which still persists in elementary schools, the stress is upon its cultural value, industrial and vocational training emphasize the distinctively practical outcome in fitting the pupil for some definite calling, for some domestic, agricultural or other industrial work. In 1898 manual training was an important feature in the public school course of 149 cities. In 359 institutions other than city schools, there was training that partook more or less of the nature of manual training. These institutions embraced almost every class known to American education, and the manual features varied from the purely educational manual training of the Teachers' College in New York city to the specific trade instruction of the apprentice school. In 1914 there were approximately 1,200 public high schools that offered courses in manual or technical training, in agriculture, and domestic economy. No reports are available as to the extent of educational or other hand-training in the elementary schools at this time.

Within the last two decades, the attention of legislative activity has been directed to the importance of hand-training, more especially with reference to industrial and vocational needs. To Massachusetts belongs the honor of leading the way in this matter in a law 20 years old, requiring every city of 20,000 inhabitants or over to maintain manual training courses in both elementary and high schools. Later on, Massachusetts again led in legislation aiding the establishment of industrial and vocational schools. By 1915 24 States and the District of Columbia had found it necessary to pass laws providing for courses in a variety of vocational work: for continuation schools, evening schools, trade schools, special classes, etc. Thus, by way of illustration, New York provides for courses in agriculture and home-making in her consolidated rural schools, for continuation schools, for trade schools, and for evening vocational schools; New Jersey provides for all-day industrial schools for boys over 14, household-arts schools for girls over 14, part-time continuation schools for boys over 14 employed as apprentices, evening industrial classes for boys or girls over 16 who are employed as apprentices, evening household-art classes for girls over 17, and vocational agricultural classes. Indiana makes provision for "fitting each individual in the State for some useful form of work" in the public school work of the State; for this purpose, the law requires that elementary instruction in domestic science and in the industrial arts be given as a part of the regular course of instruction in all the schools — in the 7th and 8th grades and in the high schools — of the State. Moreover, the law provides for vocational departments and schools conducted for the sole purpose of preparing for efficient and productive work in the shop, in the home, and on the farm.

The highly organized graded school of to-day is quite young. The War of Independence and the subsequent need for organizing and extending the new territory and of establishing means of intercommunication and other economic facilities had deflected attention to the scanty

provisions for public education. At the same time immigration brought many poor and ignorant families, and illiteracy was growing apace. A new enthusiasm and an intensely popular movement, however, set in when in 1837 Horace Mann and Henry Barnard began their educational work, the one in Massachusetts, the other in Connecticut and later (1843) in Rhode Island. From these beginnings and within less than 80 years, the elementary division of our public school system has been evolved. Within the past 40 years, there have come to our public elementary schools among many other commendable features grouping by grades, trained teachers, enrichment of studies, care for the health of the children and for their general well-being. The most significant steps in the functional reorganization of the elementary school came within recent years: in the first place through efforts of the college to shorten the time required for college graduation by reducing the elementary school period to six years instead of eight or nine; and, subsequently, to free the public school generally from its all but exclusive subservience to college ideals in order that it might be enabled to serve also the needs of industrial, commercial, agricultural and domestic life. With this in view, the course of the elementary school is being more and more generally shortened to six years, to be followed by an intermediate course of two or three years and by a high school course of four or three years.

Six-three-and-three Plan.—Among the various plans proposed and set in operation for the purpose indicated, the six-three-and-three plan is probably the most favored. It reduces the elementary school to six years, establishes an intermediate school, or "Junior High School," of three years and a full-fledged high school of three years. In both the intermediate and the high school the courses are flexible and promotion is by subjects not by grades. Instruction throughout is departmental and in the hands of persons who combine the qualities of the teacher with those of the expert. The curriculum of this intermediate school affords much opportunity for differentiation. All, it is true, share in pursuits that reveal the duties of citizenship and open avenues to the appreciation of the refinements of life. Yet, for each one there is opportunity to emphasize what talent, genius, necessity, or even inclination may demand. This flexibility of the course with its wealth of opportunity enables the student under the teacher's guidance to "find himself," his capacities and enthusiasms with reference to the choice of a life-career. Thus the intermediate schools of Los Angeles offer five distinct courses: the literary-scientific course, the engineering preparatory course, the mechanic arts course, the home economics course, and the commercial course. Aside from its many internal advantages, this coming intermediate school confers the great boon of holding the children under instruction for a longer period and of bridging the fatal chasm between the elementary and the high school, leading a greater number of children into the high school proper in its academic, scientific, technical, commercial and other quasi-professional departments. The work assigned to the elementary grades remains practically the same. Courses of study deal with reading, writing, arithmetic, spelling, the use of the vernacular, nature study, the history of our country (biographical and chronological), some geography, hygiene, physical culture, music, drawing, and some phases of manual work, mostly in connection with other subjects of instruction or with the plays of the pupils.

Problems.— The problems of truancy, retardation and varying endowment are destined to become important factors in the reorganization of the elementary school. These problems became urgent with the sincere and consistent enforcement of compulsory education laws about 1890. It soon became evident that the physical and mental conditions of children are not uniform and that individual differences in children demand serious consideration in their education. The fact that children vary widely in their natural gifts and inclinations and the clear discovery of eye, ear and motor-mindedness in children, forced upon the school demands of greater flexibility in method and organization. At first, the attention was chiefly upon mere truancy and certain disciplinary faults. Then, and until quite lately, the stress was upon the needs of laggards; ungraded rooms, so-called industrial schools, special help devices, shorter promotion intervals and promotion by subjects came to be applied as remedies; for abnormal children special schools were established. At last it has come to be fully realized that retardation is an individual matter, that it threatens the specially gifted through lack of interest as much as it falls to the lot of the less favored through lack of ability, and that it was necessary to make provision for all the various phases of individual capacity. In 1911, therefore, it became possible for the Commissioner of Education to report that provisions for backward children had been made in 220 cities, for mentally defective children in 99 cities, and for exceptionally gifted children in 54 cities. Prominent among the last were Baltimore, Indianapolis, Lincoln, Rochester, and Worcester. The provisions of all these cities were based upon the desire to furnish these children opportunity in the 7th and 8th grades to do advanced work for which they could receive credit when entering the high school. Many educators, however, doubt the wisdom of singling out such children and separating them from the classes of normal children. They emphasize the social value of joint training upon the development of character. They point out the fact that children have likenesses as well as differences and that in the school they should learn to work together as they will have to do subsequently in life; that, therefore, they should be trained together, although each in his own way and according to his ability in common work. Teachers are deeply interested in the problems involved, since from their study valuable contributions to the progressive reorganization of the elementary school cannot fail to flow.

Gary Plan.— A new departure in school management which is attracting much attention proceeds from Gary, Ind., under the direction of Superintendent William A. Wirt. The city of Gary is located on the shore of Lake Michigan, about 30 miles southeast of Chicago. When it was founded in June 1906 the site was a waste of shifting sand dunes dotted with marshes. To-day it is a flourishing city of approximately 50,000 inhabitants, with all the public utilities

and aspirations of a modern city. In 1906 four teachers taught 120 pupils in its first schoolhouse; in 1916 the number of teachers had risen to nearly 200 and that of pupils to more than 6,000. The Gary plan of a school plant is "a playground, garden, workshop, social centre, library and traditional school combined under one management." For these purposes the new Frœbel School, erected at a cost of $350,000, stands upon a tract of 10 acres; one-half of this is used for playgrounds, two acres for school-gardens, and three acres for park. There are also two conservatories for nature-study work, the botany work in the high school, and for supplying plants for the schoolrooms. Among the striking features of the work, the following are the most noteworthy:

1. The schools are open the year round, or for four quarters of 12 weeks each. Pupils are held to attend school for three of these quarters, choosing for vacation the one that suits them and the home best. During the free quarter the pupil may attend voluntarily any of the activities of the school or, with the help of the school, find employment in the industrial life of the city.

2. The elementary school and the high school are in the same building. This, it is claimed, removes the chasm between the two departments and tends to hold pupils in the school for longer periods. Moveover, it establishes the same standard of discipline for all grades, increasing sense of responsibility on the part of the older pupils and stimulating worthy ideals on the part of the younger.

3. Throughout, the teaching is departmental. This renders it possible to promote pupils by subjects, to employ skilled special teachers and to do away with supervisors.

4. The school plant is open on Saturdays. Pupils come and go as they please, work or play as they choose under teachers who receive extra pay for this work. The responsibility placed upon pupils who avail themselves of this stimulates initiative and has a tendency to "transform the play impulse into the work impulse."

5. Similarly, certain schools are open four evenings per week for continuation school work and for "social and recreational centre" activities.

6. Constant utilization of the school plant by double the number of classes as compared with the number of available classrooms. This involves the constant use by successive classes of the auditorium, the basements, the library, the gymnasium, and various portions of the playgrounds in such a way that no part of the plant is ever idle during the entire schoolday.

Other phases of the work, still in progress of evolution promise equally valuable contributions to school management. Indeed, the results already attained by Superintendent Wirt have induced a number of cities to seek at least partial enjoyment of the benefits of the Gary plan. Prominent among these is New York which is making extensive experiments with it under the direction of Superintendent Wirt, not without prospects of success.

Among a number of other features in the progressive development of schools within the past two decades, a prominent place belongs to increasing attention to sanitation, to the care for atypical children, the organization of parent-teachers associations, the use of schools as community centres.

Sanitation.—With reference to sanitation, it is reported that in 1914 there were over 500 open-air schools in the United States and that throughout open-window ventilation is gaining ground. Forty States have enacted laws relative to the sanitation of school plants, involving the inspection of schools and approval of plans for new buildings, and the right to compel improvements. In a number of instances, these laws extend to rural schools empowering the county superintendent to condemn faulty structures and to inspect and pass on plans for new buildings. Medical inspection laws relate to compulsory health supervision of school children; to examination of teachers and janitors and to regular inspection of buildings, premises and drinking water in order to insure sanitary conditions; inspection to control contagious diseases; annual tests for sight and hearing; provision for the employment of school nurses; penalities or other provisions for the enforcement of the laws. That steady gain is being made in cities appear, from a summary of returns made by 1,406 cities to a questionaire, sent out by the Bureau of Education in 1914. These returns show, among other things, that 750 of these cities have some form of medical inspection; that 570 have inspection of ears, eyes and teeth, 62 of ears and eyes only, 90 of eyes only, and 29 of teeth only; that 268 have school nurses, and that in all 923 school nurses are reported; that 130 cities have dental clinics and 195 treat the teeth of school children through other agencies; that 74 have general clinics and 33 psychological clinics under expert direction. On the other hand, the sanitary condition of rural schools still is described as deplorable. Indeed, it is pointed out on the basis of comparative statistics concerning defects of school children of the cities and rural districts of five of the older States that for all defects except two, the prevalence of defect was much greater among the children of the rural schools. This is attributed largely to low architectural and sanitary standards in rural regions; ignorance regarding the physical, mental, social, and moral effects of unattractive and insanitary school buildings; false economy of school boards; and lack of State supervision and assistance. However, as indicated above, inroads are being made by means of suitable legislation, by normal schools and educational associations, so that improvement cannot tarry long.

Surveys.—The tendency to secure improvement of schools in both rural and urban districts through the agency of careful surveys of existing conditions and needs is steadily extending. In tracing the development of the movement in an address delivered in 1915, Dr. Leonard P. Ayres, director of the division of education of the Russell Sage Foundation, gave an account of the important features of the 30 surveys made up to the time. The following data are culled from this report. These surveys were carried on: seven by individuals, six by universities, five by bureaus of municipal research, three by State departments of education, three by foundations, two by the United States Bureau of Education, two by municipal departments, and two by national societies. The directors of the surveys were professors of education, 13; special investigators, 11; direct-

ors of foundations, four; the United States Commissioner of Education, one; superintendent of schools, one. The cost figures for the different surveys varied from $500 (Montclair, N. J.) to $125,000 (New York city). The time required varied from three months to two years and two months. From 1 to 12 individuals were engaged in each survey; and the published reports varied from six pages to 2,573 pages in size. Much good has come to the systems thus surveyed in the relation of supervising and teaching forces to each other and to boards of education; in the vitalizing of courses of study and methods of work; in securing minimum standards for drill work, notably in the three R's, setting free much time for work of greater value. As a result many new surveys are being called for by city and rural school authorities. A number of cities, indeed, have established permanent bureaus of efficiency. Notable among these are Boston, Detroit, Kansas City, New Orleans, New York and Oakland.

Parent-teachers' Associations.—Ideally, the public school is an organic factor of our democracy. By it the coming citizens are to be fitted in knowledge and character for the performance of their duties. On its work depends the political and economic welfare of the state, as well as the individual and social welfare of each coming citizen. It is obvious, therefore, that fathers and mothers should feel a direct and personal interest and civic responsibility in the organization and work of the school, an interest and responsibility that cannot wholly be delegated to representatives. To such considerations the school owes the organization within recent years of mothers' clubs, parents' guilds and parent-teachers' associations which by their very existence have been and are exerting a highly beneficial influence upon the progressive development of the school. In a general way, the object of these associations is co-operation between the home and the school, to induce the school to consider in its work the needs of the home and to induce the home to aid the school in its attempts to meet new conditions and civic needs. In a city of 100,000 inhabitants in the Middle West such associations provided pianos, valuable art objects, stereoscopic lanterns and slides, and other physical apparatus, thereby declaring emphatically and in most amiable fashion that in the opinion of the people music, art and science had a legitimate place in the curriculum. Elsewhere the schools owe to such organizations in a large measure the establishment of kindergartens, the teaching of domestic arts, the enrichment of school libraries, the introduction of school luncheons, the encouragement of schoolgardens, of school festivals and school exhibits. They arrange for round table discussions of topics relating to the children's health, their conduct in and out of school, the nature and value of play, the influence of environment and every phase of child-study (q.v.). They invite experts to lecture on similar and other timely topics.

Social Centres.—Of deep significance for the further development of the elementary as well as for the other departments of the public school is a correlated movement of recent origin, namely, the wider use of school buildings for "social centre" and "community centre" activities. Aside from the fact that it utilizes the costly school plants for worthy purposes of public import at times when they are not needed for the direct purposes of the school, this movement means that the people are begining to realize the deeper fact that the school has not completed its work when it has dismissed its pupils to enter upon some way to earn a living and that these young people still need opportunity for further social and character development as well as for additional instruction under wholesome conditions. The movement originated in efforts to vitalize the work of rural schools by a variety of social occasions interesting to parents and in the needs of parent-teachers' associations in cities; but within less than a decade it has assumed wider proportions. In 1915 the Bureau of Education received reports from 603 cities of 5,000 inhabitants and over, detailing the more or less extended adoption or admission of social, civic and educative activities in their schools. Among the activities mentioned the following are prominent: meetings of mothers' clubs, parent-teachers' associations, women's civic clubs, musical organizations, art clubs, Chautauqua circles, Boy Scouts, Campfire Girls, gymnastic clubs, dramatic and literary clubs, debating societies, lectures, evening schools for a variety of purposes. Already 18 States have secured legislation permitting the use of schools for the purposes indicated.

The management of these activities still is in an inchoate condition. In Youngstown, Ohio, the local playground association provides for supervisor and supports social centres in the schools. In Trenton, N. J., it is the Social Centre League, assisted by the principals and teachers. In Plainfield, N. J., there is a citizens' committee on evening recreations in which the Board of Education is represented by its president and the superintendent of schools. In Grand Rapids, Mich., the park and school boards together maintain a department of municipal recreation. Philadelphia has a municipal recreation commission and in Kansas City, Mo., the public welfare board co-operates with the board of education. Quite steadily, however, the responsibility is passing into the hands of schoolboards and its employees. Thus, in Pittsburgh, Pa., the direction is in the hands of the director of evening schools; Cincinnati has a special director of social centres; in Boston, a similar official works directly under the superintendent of schools and has the advisory assistance of the Women's Municipal League; in Milwaukee, a special department of school extension controls the after-school activities.

Increasingly, too, we find in new elementary school plans adaptations to the new uses of the buildings. Prominent among these are auditoriums, gymnasiums, lunchrooms, plunges, library rooms, swimming pools, in one case a pair of bowling alleys. In the equipment movable the Women's Municipal League; in Milwaukee, the social centre directors are provided with amply furnished private offices; many of the rooms intended for recreational work are in the basement and have been made attractive through the use of paint, pictures, book cabinets and a supply of suitable chairs and tables. The assembly rooms are provided with large electric lamps of high power and stoutly screened to adapt the room for basket ball and similar games. In most of these large rooms there are

also trough footlights and sliding curtains, as well as motion picture booths.

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EDUCATION, Engineering. One of the most marked features of recent educational history is the increasing attention given to engineering education. Engineering has been defined as the direction and control of the forces of nature for the use and convenience of man; but until comparatively recently there was no systematic attempt to formulate the principles of engineering nor any organized effort to instruct beginners in these principles.

Engineering education, the application of the sciences to the needs of man, in this country has been a growth entirely within the past 100 years. At the beginning of the 19th century organized instruction in engineering was confined to two or three schools on the continent of Europe. The United States Military Academy was founded in 1802, and for about 30 years was the only organized agency for engineering education in America. For three-quarters of a century a surprising proportion of the graduates of this institution practised engineering in civil life, not because the education there given was what would now be called engineering instruction, but because it was the best preparation for engineering practice that could then be obtained. At Troy, N. Y., between 1825 and 1835 was established the first institution in the world for giving instruction in engineering not military. In the next 30 years only four engineering schools were founded, of which only two were really entitled to the name engineering. At the close of the Civil War the graduates of the engineering schools, exclusive of West Point, numbered less than 300.

In 1862 Congress passed an act giving to the several States public lands for the benefit of "instruction in the arts and sciences relating to agriculture and the mechanical arts"; and shortly after the close of the Civil War many of our engineering schools were organized under this act. Never was there a movement more timely or more successful than this, since it has resulted in the establishment of 64 technical colleges — at least one in each State and Territory. Fifty of these give instruction in one or more branches of engineering.

At present there are something over 100 institutions claiming to give instruction in engineering, of which more than 100 give more or less complete courses in one or more branches of engineering. Of these institutions, 67 offer complete courses in civil engineering, 61 in mechanical engineering, 49 in electrical engineering, 21 in mining engineering, 15 in architecture, 2 in naval engineering and 2 in sanitary engineering. The number of students in these courses has increased with astonishing rapidity in recent years; in 1889 there were 3,043; in 1899, 9,659; in 1900, 11,874; in 1901, 13,753; in 1910, 30,329. The rate of increase is most remarkable; during the first decade above the average annual increase was about 660, while during the last three it is practically 2,300. The increase in the number of students pursuing an engineering course is much greater than the increase in the number of male students pursuing a non-engineering collegiate course; in 13 years the former increased 444 per cent, while the latter increased only 48 per cent. At present the engineering students constitute 21 per cent of the total number of male students pursuing a collegiate course.

But the most significant fact connected with the growth of engineering education is the improvement in the methods employed and in the scope of instruction. The teaching force of the engineering schools has been increased and the material equipment has been extended, thus permitting a radical change in the methods employed and in the scope of the instruction given. The best engineering colleges of America are offering unexcelled opportunities for the acquisition of the fundamentals of an engineering education. Few, if any, Americans now attend European engineering schools, for it is generally conceded that the American schools, in equipment, methods and scope of instruction, are superior to any European schools — at least for American engineers. German and British engineers quite generally concede the greater effectiveness of American methods of engineering instruction, particularly in the use of fully equipped laboratories and shops and in the value of various forms of practical instruction. The curriculum of the engineering college at present consists of about 10 per cent of English or modern foreign language, usually the latter; 30 to 40 per cent of indirect technical studies, as mathematics, physics and drawing; and 50 to 60 per cent of technical work. Over half of the engineering students are in institutions requiring for entrance the completion of a four-year high-school course, and another quarter require a three-year high-school course.

At the beginning of the specialization of engineering education practising engineers doubted or denied the value of a technical training for young engineers, and distrusted the engineering graduate; but now general managers and chief engineers prefer technical graduates, since they have been trained in scientific methods of working, and have a knowledge of the fundamental principles underlying all engineering practise, and look out upon the world of truth from the viewpoint of a man of science. The national engineering societies now give

credit for training in the engineering school toward the requirements for admission to membership, and the most cordial relations now exist between practitioners and the schools of engineering. Within recent years, largely if not mainly through the influence of the technical colleges, engineering has ceased to be traditional and has become scientific; and engineering has come to be recognized as a learned profession.

The wonderful growth of engineering education is of interest to the young man who is trying to choose a lifework; but it is of vastly greater importance to the citizen who is interested in the continued growth and prosperity of the country. For the past few years our newspapers and our magazines have had much to say about our rapidly increasing foreign trade, chiefly in the way of recording its marvelous growth, but with little attention to the factors that make such success possible. Of course, such a result depends upon many elements, among which are: (1) the peculiarities of our national ancestry, which has peopled this country with the brightest minds of all nations; (2) our political constitutions, which make it possible for the humblest to rise to the highest position; (3) the fact that we are a great nation, speaking one language, with no barriers in the way of the freest social and commercial intercourse; (4) our great and varied natural resources of mine, forest and soil; (5) the high price of labor, which stimulates the introduction of labor-saving machinery; and (6) the general dissemination of education, which made possible the effective use of labor-saving machinery and permitted the nation to profit by the capable and ambitious workers of all classes.

But since 1900 we have entered upon a new phase of national and industrial life. Until then we had been engaged in subduing the great West, in establishing homes, in founding cities, in building railroads. By legislation we barred out foreign competition and preserved the home market for our own products; but now the new land in the West is occupied and there is no longer an outlet in that quarter for our surplus labor and our industries have outgrown the home market. If prosperity is to continue in the future as in the past, we must have new markets; and in these markets we must meet the competition of the world. What are the conditions necessary for success in that field? The modern commercial history of Germany and Great Britain is significant.

For many generations Great Britain was preeminent in manufactures and in commerce. In 1870, she did one-quarter of the world's business, and the English believed that their industrial supremacy was secure; but in a single generation they were awakened to the fact that they were rapidly losing ground and in some respects were already third in the race. With Germany the almost exact reverse was true. Thirty years before she had a comparatively unimportant place in the commercial world, but in a single generation all this had been changed. The power employed in manufacture had increased four times as rapidly as the population, and the tonnage of the ships engaged in foreign trade had increased ten-fold. From 1870 to 1895 German foreign trade increased 42 per cent, while the English increased only 13 per cent; and from 1895 to 1900 German foreign trade increased $200,000,000, while England's increased only $30,000,000. Why is it that Germany, with one of the poorest seaboards in the world, with a poor soil and with a dangerous military position, was thus able in a single generation to outstrip England — the mistress of the sea and the foremost manufacturing nation of the world?

The modern marvelous industrial development of Germany was coincident with and dependent upon the development of industrial education. About 30 years ago Germany reorganized and strengthened her technical schools and established many new ones, until the provision for technical education became the wonder and admiration of all who know the facts. In the number and equipment of her technical schools Germany led the world. She was fully alive to the commercial importance of scientific investigation and technical education.

England a few years ago, confident in the superiority of her own manufactures, passed a law that all foreign-made goods should be labeled with the name of the country from which they came. This stamp was intended to be a mark of inferiority; but, to the surprise of the British, the label "Made in Germany" appeared on the highest grade of goods, which the Englishman had assumed to be of home manufacture. England received another shock when she found her street railroads being supplied with electrical apparatus made in America, and when she discovered that her manufacturers were importing American machine tools, and when America obtained the contract for bridges in her African and Indian colonies. After vainly endeavoring to convince herself to the contrary, England is ready to admit that she is being distanced in the industrial and commercial race, because she has not kept alive to the intimate relation between science and industry, and that in neglecting the technical education of her people she has failed to train her industrial army. In these days of sharp competition and small margins, when the entire world is in the market, the nation that most carefully trains its industrial army will gain industrial supremacy. Of course, there are other factors, as wages, labor unions and tariff; but not one of them is of such transcendent importance as that training of the individual which enables him to produce the most in the least time and at the smallest cost.

What is the lesson for the United States? It is, that if this country is to extend or maintain its foreign trade it must look carefully to higher education. We already have a goodly number of technical colleges, but in number and equipment they are inferior to those of Germany, although in method they are better adapted to American conditions than would be the German type. Most of our technical schools are in need of additional equipment and more instructors. Technical education in this country was inaugurated about 30 years ago, and the engineering education given now is vastly better than that of 25 years ago; but there is still opportunity for improvement. The one thing necessary is adequate financial support. Technical education, especially engineering education, is very expensive. A large and costly equipment is required, and machines and apparatus wear out or become antiquated and must be replaced by new. Our technical schools need a more generous support, so that they may add to

their facilities and extend their courses. Any money given for this purpose is wisely expended, for experience has abundantly proven that money given to technical education is returned many fold in the increased productiveness of the nation's industries.

To be most effective, technical education must be practically free. Unless it is, many will be debarred from its privileges, and society will be dependent upon a few workers from a favored class. One of the main reasons why the United States has been so prosperous in the past is that education has been free, and consequently the higher ranks have been continually recruited from the lower. The way should be open that the humblest may rise from the lowest to the very highest rank. Education should not be bestowed as a charity, nor as a means for helping the recipient to earn a livelihood, but because the proper education of the people is the only basis for social security, economic prosperity and the highest national development. The conclusion almost certainly follows that only the government has the ability to make provision for the adequate technical education of the people. The Federal government and the States, particularly the North Central ones, have made magnificent provisions for technical education; but the numbers seeking it require increased equipment and the change in industrial life demands a higher grade of work.

At present the engineering college is engaged chiefly in giving the rudiments of an engineering education, but it should do more than simply impart elementary instruction. There are numerous scientific and practical subjects that are very much in need of investigation. The practising engineer frequently encounters problems which ought to be investigated experimentally, but it is seldom that he can command the necessary laboratory equipment or find the time for such work. There should be some place where such problems could be sent for solution; and where is a better place than a research laboratory established in connection with a technical school? Much of the equipment required in the work of instruction could also be used in research work. The professors now do more or less such work, but they are usually, and rightly, employed because of their ability to teach and the impartation of instruction consumes so much of their time and energy that they cannot do much in the way of investigation. There should be trained corps of men engaged in original research in matters relating to engineering and manufactures, much as is the case with agricultural experiments and investigations now being carried on at most agricultural colleges. Many such investigations are returning to the public each year benefits equal to more than a hundred times their cost. Of these a few are: The breeding of cotton and of corn, the prevention of smut in oats, and the spraying of apple trees for the destruction of harmful insects. Why should not similar aid be given to our manufacturing interests?

The following are the words of a prominent practising engineer: "The cost of duplicating the land, buildings, equipment and endowment of the largest and most complete technical school in the United States, training more than 1,500 young men, is little more than half the cost of one of the latest battleships, and the running expenses of one of the largest technical schools are about the same as for keeping a battleship in commission. The technical school has a use no less important than the battleship in the 'first line of national defense.' The time has already come when the commonwealth and the nation should contribute more liberally to the burden of its support and help it to ever broader usefulness. The demonstration of its great value to the prosperity of the state is already complete. With the increasing numbers of students and with the rapidly increasing cost of laboratory facilities needed for the best training, the need of funds is greater than private munificence can be relied upon to meet. In the reawakening of the old spirit of commercial adventure in foreign lands, we must to-day base our hope of success on superior excellence and economy of manufacture and in the calling of our engineers to foreign lands. The growth of our cities is laying a burden of new and larger problems on our departments of public works, a burden which only those trained in the schools of engineering can carry wisely and well. The business man, when he comes to see these matters clearly, will urge again and again a generous support to schools of engineering by city, state, and nation when private munificence falls short."

The increase in the number of engineering students attending college has not been as great in recent years as in the period covered by the statistics in the earlier part of this article. The number of engineering students reached a maximum about 1910, and fell off about one quarter during the next five or six years. This falling off occurred in all engineering courses, but was most marked in civil engineering; and was due to legislation affecting the rates of railroads and public utilities and the development of water powers which caused a curtailment of expenditures in those lines. However, in the meantime, the number of engineers finding employment in other lines greatly stimulated the demand for engineers in new fields; and before the world war disturbed industrial and financial conditions in this country, the demand for engineers exceeded the supply. It is generally and confidently believed that after the close of the war there will be a greatly increased demand for technically trained engineers.

Since the assault of Germany on the peace of the world, there has been a general tendency to look with suspicion upon anything of German origin; and hence a few words concerning the reference above to German technical education may not be out of place. Unquestionably Germany for a generation before the great war had a marvelous industrial and commercial development, and also unquestionably it was largely due to the attention given to higher technical education. The rest of the world may profit from a study of the causes of Germany's great development without approving some of the commercial methods and social results or her military motive.

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EDUCATION, Health. See HEALTH EDUCATION.

EDUCATION, Higher, in the United States. In the transit of civilization from the Old World to the New, higher education played

an early and conspicuous part. The proportion of university men among the colonists of Massachusetts Bay was large. Between 90 and 100 English university men were among the emigrants prior to 1648, or 1 in each 200 or 250 of the total population of the colonies. Seventy were graduates or former students of Cambridge, 20 of them from the able Puritan foundation, Emmanuel College, and had there learned the love of truth and sense of duty that signally characterized their later lives.

These men became the leaders in church and public affairs in New England, and one of their earnest desires was the creation of a new Cambridge University near Boston. It was only six years after the founding of Boston that their dream had partial realization in the founding of Harvard College, for on 28 Oct. 1636, the General Court "agreed to give 400 pounds towards a school or colledge." "After God had carried us safe to New England," writes the chronicler, "and wee had builded our houses, provided necessaries for our liveli-hood, rear'd convenient places for God's worship and settled the Civil Government: One of the next things we longed for and looked after was to advance learning and perpetuate it to Posterity: dreading to leave an illiterate Ministery to the churches, when our present Ministers shall lie in the Dust." Two years later John Harvard, a clergyman who had been a year in the colony, died and bequeathed one-half of his estate and his precious library of 300 volumes to the enterprise. This, with other gifts, enabled Harvard College to open.

Founding of the First Colleges.— Attempts to found a college in Virginia began before the *Mayflower* sailed to Plymouth, in the grant of 10,000 acres for a university made by the Virginia Company, but it was not until 1693 that the planters, suffering from sickness, poverty and massacre, were able to obtain sufficient aid from England to found their "place of universal study." The entire population of the colony, if gathered together from the scattered plantations, would hardly have filled a sizable city, and the college could hardly have prospered without the liberal aid which it received as a child of the Church of England: aid to which the dissenting colleges of the northern colony could not appeal. Had the English sovereign and the High Churchmen who lent substantial assistance been able to foresee the infant college becoming the mother of rebellion and the "training ground of democracy," inspiring the students, Jefferson, Monroe, Tyler and Marshall and their colleagues with faith in the inalienable rights of man, and granting Washington his surveyor's license, they had perhaps been less prompt with their gifts.

Tradition has it that the third American college, Yale, had its origin in the bundles of books which the founders are reputed to have carried to Branford as endowment for the little collegiate school that held its commencement at Saybrook. A child of Harvard, the school was founded in 1701, that the youth may "be instructed in the Arts and Sciences, who . . . may be fitted for Publick employment both in Church and Civil State." The college found a permanent home in New Haven after more than a decade of migratory existence. It received firm foundation in the liberality of Gov. Elihu Yale, a wealthy English colonial official born in Boston and resident in London, who shipped consignments to be sold for the benefit of the college and gave also many books to the college library. Equally generous was the great English philosopher, George Berkeley, who gave nearly 1,000 volumes, "the finest collection of books ever brought to America at one time" as well as the "Dean's" farm which he had occupied in Rhode Island. The colonists gave from time to time as they were able, sometimes land, sometimes books, material, labor or physical apparatus, and the general assembly appropriated annually £100 or £200 besides special appropriations. Successful foundation came to Yale, as to all the other colonial colleges, only at the price of common sacrifice, and liberal public policy at home, and generous aid from England.

Benjamin Franklin in his 'Proposals Relating to the Education of Youth in Pennsylvania' laid the framework of the future University of Pennsylvania. The narrow curriculum of the New England college and the Latin and Greek declamations and recitations seemed insufficient to Franklin. "It would be well," he wrote, "if they (the pupils) could be taught everything that is useful and everything that is ornamental. But . . . their time is short. It is therefore proposed that they learn those things that are likely to be most useful and most ornamental, regard being had to the several professions for which they are intended." Twenty-four citizens of Philadelphia undertook to establish an academy of the type suggested and to lay foundation for posterity to erect a more extensive and suitable seminary. In January 1751 the academy formally opened. It embraced an English, a Latin, and a mathematical school with wide range of studies.

William Smith, author of a broad plan of education for an Utopian college of "Mirania," was chosen provost of Franklin's academy, and guided the institution through its notable, if tumultuous, early history. He bitterly disappointed Franklin, quarreled with the provincial assembly, and was believed a Tory at heart, but he built into fact enough of his own and Franklin's early ideals to make the college of Philadelphia a model for all later American colleges.

Princeton, founded in 1746 as the College of New Jersey, had for predecessor the Log College of William Tenant, near Philadelphia, a college of the simplest type where, with Tenant's four sons, future clergymen of the Presbyterian Church received instruction and council. Princeton influence was active in the foundation of Brown University in the Rhode Island colony, organized by the Philadelphia Baptist Association under the agency and presidency of the Rev. James Manning, a graduate of the New Jersey College.

Kings College in New York (now Columbia) owes its origin to the joint interest of the colonial assembly and Trinity Church. The assembly declared its belief that a proper and ample foundation for the regular education of youth would greatly tend to the welfare and reputation of the colony and voted an annual appropriation of £500, in addition to author-

izing lotteries, believing "so good and laudable a design must readily incite the inhabitants to become adventurers in a lottery." Trinity Church offered "any reasonable quantity of the church farm" for the college buildings on condition that the president be forever a member of the Church of England and that the liturgy and collect of the Church be used. Bitter dispute ensued between the Episcopal party and the minority who seem to have had in mind the erection of a non-sectarian university under the direct control of the assembly. If the plan for the new college was not as liberal as the minority wished, it was in practice less sectarian than any college yet erected.

Dartmouth, established by the Rev. Eleazer Wheelock in 1769, was an outgrowth of Moor's Indian Charity School. Ten thousand pounds were collected for it in England. Situated on the frontier of the Indian country, remote from populous towns and white settlements, it early worked out a rough sort of vocational training that was prophetic of a later day.

Rutgers, established by royal charter as Queens College, in New Jersey in 1766, completes the list of the nine living colonial colleges. Twelve were founded in the colonies prior to the Revolution, but the others did not survive.

The colonial colleges were not mere copies of English prototypes. Each has an individuality of its own. Each smacks of the soil of its own primitive community. Each retained permanent characteristics given by the groups of able and independent men that founded and presided over them. Their achievement is a great one. They realized the hopes of their founders that learning might not perish in the new world and that able leaders in church and civil affairs might not be wanting, but they did more.

They furnished the leadership in the great debate with England in legislature, in pamphlet and newspaper that preceded the Revolutionary War; they furnished a notable proportion of military leaders and soldiers in the terrible struggle, and they supplied largely the practical statesmanship that joined the discordant colonies into united resistance and later into one nation. Without the colleges the Revolution could not have succeeded or would have been deferred for a generation.

The colleges paid the price. All but one or two were forced to close their doors for a time. For a time Harvard's dormitories resounded with the heavier footsteps of provincial troops. Washington took command within a few rods of the college yard and occupied the president's house as his headquarters. The scientific apparatus was removed to Andover and instruction was given in Concord. Yale found her work interrupted and resumed for a season a migratory life. Her president was subjected to indignities and the students suffered from shortage of food.

Princeton was the scene of a crucial battle of the war: Nassau Hall still bears the scars of battle and gave shelter in turn to provincial and British troops. Brown's Hall was used as a barracks and hospital. Kings students drove the Tory president into exile, but the college buildings were later occupied by British troops and no commencement was held between 1777 and 1786. William and Mary was used by Washington as a hospital, and Queens College was forced to remove to the north branch of the Raritan to escape active hostilities. Remote Dartmouth alone seems to have continued undisturbed in her scholastic pursuits, but suffered the loss of her Indian students, allies of the British. These colleges all, however, survived the struggle and before the century closed their number was increased by 17 new foundations, among which were Hampden-Sidney (1776), Washington and Jefferson (1787), Dickinson (1783), Georgetown (1791), Williams, (1793), Bowdoin (1794), Union (1795), University of North Carolina (1789), University of Vermont (1791), and Middlebury (1800).

Government Aid.— Although generally founded as independent, self-governing corporations closely related with some religious denomination, practically all the early colleges received generous aid from the colonial or home government either in gift of money, grant of land, lottery, privilege or special tax. The provision was, however, pitiably small. The total property of the colleges at the end of the 18th century has been estimated as not in excess of $1,000,000 in value. The present property of the colleges and universities is nearly 800 times as great. The equipment of the early colleges was of necessity of the simplest. A few books were the first essential, as the gifts of John Harvard, Elihu Yale and Bishop Berkeley abundantly indicate. Food and dormitories for the students, a house for the president, simple apparatus for those colleges which offered courses in natural philosophy and astronomy, and an unpretentious college hall were the other usual requisites. William and Mary had for the time a notable building designed by Sir Christopher Wren. Nassau Hall was esteemed one of the finest buildings in the colonies. College Hall in New York was "exceedingly handsome, the most beautifully situated of any college in the world." But these were the exceptions. The president's house often served as place of recitation. He was often the sole member of the faculty, teaching all the subjects of the curriculum. The faculty and tutors were always few in number.

A New Era.— The close of the Revolution ushered in a new educational era. Some of the colleges, as Kings, were virtually defunct and required refounding. Others had suffered so severely that larger appropriations were needed than the impoverished States could well afford. But chiefly significant is the new patriotism that preferred education at home to education in Europe and the new conception of education as not primarily a church function but as an instrument of national spirit and national life. The new impulse came in part from France and was in part the natural result of newly-won national independence.

The University of the State of New York was founded 1784–87 to ensure an organized system of higher schools adequate to the needs of the State. The State of Georgia provided in 1784–85 that all public schools instituted or to be supported by funds or public money shall be considered as parts or members of the University of Georgia. Thomas Jefferson be-

lieved profoundly in the new educational faith. As press of other duties permitted, he concerned himself with the project of developing in Virginia, as a model for all the States, a true organized system of schools crowned and controlled by a State university. The plan was proposed in 1779 and partly carried out in 1796. It was not until his old age that he found time to incarnate his idea in the foundation of the University of Virginia. Jefferson founded in the university a new type of institution. The purpose of a State university he considered to be (1) To form statesmen, legislators and judges; (2) to expound the principles and structure of government, the laws which regulate the intercourse of nations and a sound spirit of legislation; (3) to promote industry, agriculture, manufacturing and commerce; (4) to develop the reasoning faculties of the youth, enlarge their minds, cultivate their morals and instil in them the precepts of virtue and order; (5) to enlighten them with mathematics and physical sciences.

Washington in his plan for a national university was moved by the same impulse. He thought a national foundation the surest way to establish an American education equivalent to that formerly sought by many American youths of good family in the English universities, and he believed that the gathering of students from all the colonies into one institution would foster a common national spirit. The plan of Washington has never yet been realized but has found support in the opinion of many of our wisest Presidents and most experienced educators.

So strong was the democratic impulse and the influence of Jefferson's university that private foundations came to be viewed with something like distrust. In some States the legislature vainly sought to obtain control of existing colleges by offer of financial support. In three States, at least, the colleges were for a brief period converted into public institutions, but soon reverted to their original character. The famous Dartmouth College Case put an end to this attempt, it being decided that the charters granted educational foundations were inalienable. The effort had greater success in the States where private and church foundations had not a firm foothold. Provision was made in the constitutions of most of the new States for the establishment of State colleges or universities to crown the system of public schools. The national government laid substantial foundation in land grants. The grants of the Continental Congress in 1787 reserved perpetually two entire townships to the States to be erected in the Ohio country for the purpose of a university. One or two townships of public land were granted each of the newer States for education and were usually devoted to the establishment of a State university. The Morrill act granted public land for instruction in agricultural and mechanical subjects in proportion to population: 30,000 acres for each member of Congress representing the State. By the acts of 1890 and 1907, $50,000 was given each State annually for the same purpose, and by acts of 1887 and 1906 $30,000 annually was granted each State for Agricultural Experiment Stations, which were usually made part of the State university or agricultural college. The effect of these grants was to stimulate the growth of State institutions and to broaden their curriculum. The great universities of California, Illinois, Minnesota, Nebraska, Ohio, among others, owe their origin to the Morrill act. In other States agricultural colleges were established, as in Massachusetts, Michigan and Iowa; and in others the proceeds were devoted to the maintenance of departments in connection with existing institutions. The effect of the national policy, joined to liberal State appropriations, was the creation of "the most comprehensive university foundation the world has ever seen" in the newer Western States. The annual appropriation of several exceeds $1,000,000 each for current expenses. In some States the proceeds of a permanent mill-tax assures a fixed minimum of income. Generally no tuition fee is charged residents of the State, in no case is the fee more than nominal except for professional study. These institutions are coeducational. Of the 100,000 women attending colleges and higher schools about 30,000 are in State universities. The State universities are maintained as an integral part of the State system of public schools and graduates of standard high schools are admitted without examination. Thus the States provide a democratic system of education aiming to make available to each of its future citizens as complete a training as the mental equipment of each makes possible.

Recently the State universities have taken upon themselves much greater tasks. They have attempted to see to it that the expert knowledge of which they are the accredited custodians shall become embodied in the practical affairs and industry of the State: that the current practice of agriculture shall apply the expert knowledge of the agricultural sciences; that actual government shall embody the principles of political and social science; that actual teaching shall embody the principles of pedagogy and hygiene.

They further interpret their obligations to the State to include not only the student body in the university but all residents of the State with intellectual interests and aptitudes. The attempt is made to extend the university over the entire State and carry knowledge directly to the people. University centres are organized wherever a sufficient number of people can be interested and instruction and lectures are given far from the campus by members of the university staff. Instruction is given by correspondence and an information service is operated by which any resident may consult the experts of the university in reference to his practical difficulties. The intelligent discussion of public questions is fostered, music, pageants and libraries are made available to any community.

Recently "surveys" have been made of several State universities. A survey is a thoroughgoing but sympathetic and constructive examination of the equipment, administration, standards, methods and ideals of the institution to determine the relative efficiency of its organization, the value of its service to the community and the potency of its ideals. Surveys may at times degenerate into "investigations," but when true to their mission are practical and constructive. The State universities investigated not only have stood fairly well the test of the

searching examination of the survey experts, but have been quick to adopt their suggestions for securing a greater "return" from the educational plant. A survey may extend to the entire educational resources of a State, and suggest a new alignment of educational institutions.

The Municipal University.— A type of college of recent development, akin in spirit to the State university, is the municipal university. The most conspicuous and purest examples are the College of the City of New York and the University of Cincinnati. The College of the City of New York was organized as an "Academy or College" in 1847. Under the presidency of John H. Finley it was developed into a great institution of collegiate standards supported by direct appropriation from the municipality. Nearly $6,000,000 was appropriated for new buildings, grounds and equipment and the annual appropriations are over $600,000. The college is distinctly city minded, and takes as its chief function the task of producing a higher type of citizen for the great city-state.

The University of Cincinnati is organized more closely after the pattern of the new State university. Its relation to the city government is very close. The political science department of the university conducts a municipal reference bureau in the city hall; the college for teachers uses the public schools for the training of students and co-operates with the superintendent of schools in the supervision of teachers and in investigations and reports. The department of psychology co-operates with the schools in the study of backward children. The department of social science co-operates with the city department of charities and the courts. The college of medicine conducts a free dispensary, maintains milk supply stations and sends out visiting nurses. It also conducts the laboratory of pathology of the City Hospital. The engineering college conducts a city testing bureau and co-operates with the various city departments doing engineering work. These are a few typical co-operative activities. Students study in the university and do practical paid work in city departments and manufacturing plants in alternate weeks. Eighty-five per cent of the men and 30 per cent of the women earn the whole or part of their own support. They participate in the things they are studying. The university conducts evening and external courses, and makes every effort to reach the larger number of men and women who but for the university would be debarred from an adequate education.

The rapid growth of city universities is evidenced by the organization in 1914 of a national association of urban universities consisting of 14 institutions. Seven of these are properly public municipal colleges.

There are now nearly 100 State and municipal colleges and universities. In them are educated approximately 40 per cent of the college and professional students of the United States. Sixty per cent still attend colleges of private foundation, of which there are 474 offering instruction of college grade or higher as measured by the United States Bureau of Education.

European Influence.— The evolution of the college of private foundation has been as phenomenal as the evolution of the State university. The colonial college has developed into the modern university chiefly under European influence. German influence in American higher education began with George Ticknor, Edward Everett and George Bancroft who were students at Göttingen early in the 19th century. They were followed by an increasing number of American students who pursued advanced studies at the great universities, especially at Berlin, Göttingen and Leipzig. On their return to America these men introduced the new methods of research into their advanced classes and through the influence of their students profoundly affected the methods, structure and ideals of the American university. The lecture system was developed. Productive scholarship became the common aim. The University of Michigan was remodeled in 1852 on the continental plan. Johns Hopkins was in its fundamental ideas founded on foreign practice and many of its professors were foreign trained. It was primarily a graduate school devoted to the development of research and publication, in science, history and medicine.

Organization and Work.— The chief marks of a complete university are (1) that it is a place of universal studies representing the entire field of knowledge; (2) that it is devoted primarily to research or the training of men for research from which follows (3) that it is devoted largely to experimentation and the elaboration of methods of research and the technique of the science; (4) that it offers the highest possible training for the great professions, law, medicine, theology and engineering. The university thus becomes a "centre of free inquiry," a "seat of true learning," a place where "thought is freed from all fetters," where "life takes cognizance of science to the advancement of both."

The international character of the higher learning is reflected in the development of international exchange of professors. Harvard and Berlin entered into such reciprocal relations in 1904. Harvard and the Sorbonne began a similar exchange in 1911, followed by Columbia and Berlin and The University of Chicago and Göttingen.

"On the maintenance of the university," says Daniel Gilman, former president of Johns Hopkins University, "modern civilization depends. No tradition, no dogma, no hypothesis and no theory can escape from scrutiny, and none can long survive if it is found to rest upon false premises, imperfect knowledge or fallacious reasoning. The universities are the discoverers and explorers of new domains. They are the modern judges of the world. The very processes they employ in ascertaining the truth are favorable to the development of critics and the education of acute and independent intellects. . . . Rare minds will first perceive the truths, and then will teach others. In due time the advanced positions of the philosophers and scholars will be occupied by the multitude and onward will go the forces of the universities to make new conquests in the dark continents of ignorance and uncertainty till there are no new fields to conquer."

The Association of American Universities represents fairly those institutions that have

approached to the requisite facilities for universal studies and the advancement of learning. The Association includes 22 institutions, one-half of which are State universities. The universities of private foundation holding membership are Johns Hopkins, Columbia, Harvard, Cornell, Chicago, Yale, University of Pennsylvania, Princeton, Leland Stanford, Clark and the Catholic University of America. These great endowed universities make and maintain the highest intellectual and scientific standards of the present. The higher degrees granted by the universities are usually the M.A. degree and the Ph.D. degree. The M.A. degree usually represents one year of graduate work and passing of a general examination and the writing of a brief thesis. The Ph.D. degree represents three or more years of graduate study, one, at least in residence, the passing of an extended examination and the writing of a dissertation based on individual research and constituting a contribution to knowledge. In 1861 the first doctorate was conferred; in 1914 over 500.

The richer private institutions have established numerous scholarships and fellowships. In this policy they have been influenced by the desire to make the private college a real democracy of talent as the State universities do by free tuition. The University of Chicago reports over 1,000 scholarships and fellowships, Yale over 400, Harvard 600, the University of Pennsylvania nearly 700. The State of New York has established a comprehensive system of State scholarships, yielding each $100 for four years in the approved colleges of the State, awarded to those who obtain the college-entrance diploma with highest rank. Seven hundred and fifty scholarships are awarded each year, making 3,000 in force, at a cost to the State of $300,000 a year. The motive in this important legislation is the same that influenced the Western States in the establishment of State universities.

The general establishment of graduate and professional schools has placed the college proper in a position of real danger. The development of the university has complicated its problem and confused its status. Many colleges are in organization not colleges but low grade universities. Properly speaking the college has its place between the high school and the graduate university or higher professional school. It may be an independent institution or one of the several schools forming a university group. A college of standard grade requires for admission the equivalent of eight years' elementary school work and four years of high school work. It requires for the bachelor's degree a four-year course or its equivalent. This brings the normal student to the higher professional school or graduate school at an age of 22 or 23, and delays the practice of his profession to the age of 26 or 27. There has been constant complaint of the length of the educational sequence and repeated efforts have been made to save time somewhere in the process. Differentiation between a junior college and senior college, by which college work may be ultimately limited to two years and university work begun in the senior college, is an interesting experiment. A three-year college course has been tried, and in some institutions a system of "combined" courses permits professional work in the fourth college year, but defers the granting of the bachelor's degree until the end of the fourth year.

Course of Study.— The influence of the university has operated to introduce into the college a greatly modified curriculum. Until 1870 most colleges provided a four-year course of prescribed studies. So rapid was the growth of the sciences, natural, social, political and applied, as well as history and philology, that the old course of study did not serve to orient the student into the modern world of thought. The problem was met by the multiplication of courses, the multiplication of professors and instructors and the introduction of a greater or less liberty of election between courses. The larger colleges offered in 1914 10 or perhaps 20 different courses for every one offered in 1875. The extreme elective system is generally recognized to have been a failure in the college as it has been a success in the university. The present tendency is to prescribe those subjects which are regarded as essential to a liberal education, to permit election between groups of related courses rather than between individual courses and chiefly in the last two years of the college course. Much has been done to introduce a greater degree of unity, continuity, breadth and system into the curriculum. A promising venture was the establishment of the perceptorial system at Princeton and since adopted in part by a number of colleges. The preceptors enter into close relationship with small groups of students, guide their reading, give personal attention to their difficulties and are able to influence their choice of studies from personal knowledge of individual aptitudes and deficiencies. Honors courses are provided in some colleges for students desiring to attain high rank in carefully selected sequences of courses. A general examination is sometimes substituted for term examinations and tests a more permanent deposit of knowledge.

The position of the college, however, is not yet secure. Its final articulation with the high school below and the graduate and professional school above has not been finally determined. That it is destined to have a permanent place in the educational system seems certain, and the solution of the crucial time problem may come with a real unification of the educational process now arbitrarily divided into four distinct and different educational stages and four types of schools, elementary, secondary, college and university.

Professional and Technical Schools.—There is space but for a few brief sentences concerning the professional and technical schools. During the colonial period many American-born lawyers sought a legal education in the English inns of the court. Equal interest in jurisprudence was not manifested after the Revolution for even the great ability of James Kent failed to attract students to Columbia University after his first year of service in 1794. The Harvard Law School was not successful until Justice Joseph Story in 1830 lent the enterprise the influence of his great name. Not until after 1890 was it firmly established that the apprenticeship system of legal education was inadequate to the increasing volume and complexity of the law, and that adequate preparation could be had only in the better law schools connected with the large universities. There are now approximately 122 law schools with over 20,000

students. Not more than one in four of these students has taken a college degree, although many have had the one or two or three years required for admission by some of the better schools.

Medical education did not attain a high standard until the founding of the medical school of Johns Hopkins University in 1893. There are now about 100 medical schools with about 17,000 students, of whom approximately one in six hold collegiate degrees. The course is usually four years. The efforts of the Carnegie Foundation and other institutions to raise the minimum standard of medical education has resulted in a considerable decrease in the total number of medical colleges and of medical students. Some of the weakest institutions have been eliminated. In 1900 there were over 150 medical schools; in 1914, 100. In 1900 there were 25,000 students; in 1914 not quite 17,000. In addition there are 50 schools of dentistry with about 9,000 students; 72 schools of pharmacy, with nearly 6,000 students, and of more recent establishment 1,250 schools for nurses with 36,000 students. The theological faculty is not as generally developed in the American university as in the German, but schools of theology abound. In 1914 there were 176 theological schools with 11,000 students and nearly 2,000 graduates annually. Less than 50 were integral parts of colleges and universities. About half the schools require a college degree for admission, and the length of the course is usually three years.

Education in engineering begins with the foundation of Rensselaer Polytechnic Institute in 1824. The creation of the Lawrence Scientific School in 1847 at Harvard and Sheffield Scientific School at Yale a little later brought a much higher standard. The influence of the National Land Grant Law in 1862 on engineering education was profound. Able schools are connected with most of the larger State universities. The leading school is the Massachusetts Institute of Technology affiliated with Harvard University. Most technical schools require four years of residence and grant degrees of like time-value with the B.A. and B.S. degree.

There are more than 200 public training schools and colleges for teachers with over 90,000 students, but in only a few of the States are the requirements for admission sufficiently high to permit their classification as of college or university grade. In addition there are 46 private normal schools with nearly 6,000 students and a few teachers' colleges of high grade, of which the most notable are at Columbia University and at the University of Chicago. The rapid advance in the application of pedagogical principles to educational practice is due in considerable part to these teachers' colleges.

The deep popular interest in higher education has tangible expression in private gifts to various institutions. In the decade from 1890-1900 an amount was given equal to the entire estimated value of the college property and productive funds in 1890, or $115,500,000. In 1914 gifts from private sources aggregated $31,357,398. Nearly $600,000,000 have been given since 1870.

Mention has been made of the fact that State universities are almost universally coeducational. Most of the colleges of private foundation in the Central and Western States also admit women in equal terms with men. Oberlin Collegiate Institute, now Oberlin College, admitted women from its opening in 1833. In the Eastern and Southern States colleges for women grew from the female seminaries founded in large numbers before the Civil War. Elmira College in New York was the first institution for women to receive a college charter in 1855. Vassar began a notable history in 1865. Wellesley received recognition as of college grade in 1877. Smith College opened in 1875. There were in 1915 nearly 19,000 undergraduates attending women's colleges.

The problem of military education has frequently demanded the attention of the Congress, the colleges and the people of the United States. Out of the experience of the Revolutionary War and the recommendation of Washington came the military academy at West Point, founded in 1802, now a college and engineering school of the highest type for the training of officers for the United States army. The Naval Academy at Annapolis, founded in 1845 by George Bancroft, the historian, performs a like purpose for naval officers. The number of cadets is strictly limited by Congressional and Presidential appointment. The present law (1916) provides for the designation of three midshipmen to each member and delegate of Congress, and in addition 10 at large and 15 from the enlisted men of the navy to the Naval Academy. Appointment to West Point will be on the basis of two cadets to each member and delegate of Congress, four from each State at large, 80 from the United States at large. The President may appoint, in addition, not to exceed 180, from the enlisted men in the army. The government maintains in addition a number of special military schools for the training of soldiers in various branches of the service.

Out of the early experience of the Civil War came the provision of the Morrill act requiring military drill at the "land-grant colleges." The National Defense Act of 1916 reorganized the provisions for military education at the State universities and agricultural colleges. Reserve officers liable for service in case of war are to be trained in reserve officers' training corps units by United States army officers detailed as professors of military science and tactics. Adequate instruction in military science as part of the regular course of study is provided. The college training is supplemented by the six weeks' summer training camps conducted by the War Department. Similar provision is made for private colleges which agree to maintain at least a two-year course of military training. College regiments or batteries exist at many universities either as independent organizations or as units of the State militia. The demand for more adequate recognition of military science and military practice by the colleges has its origin largely in the student body and is receiving much attention from the college faculties. The introduction of an element of military discipline into the free life of the college is looked upon with favor by many college presidents.

In the history of higher education in America the first 15 years of the present century represent an area of criticism and reconstruction. Out of this era our universities and colleges emerge confident, potent, alert, with a quickened sense of their high responsibilities, a

clearer vision of their mission and an immensely increased knowledge of educational methods. A new world epoch in educational history will doubtless begin with the close of the European War. What the characteristics of the new epoch will be no one can foretell, but it is a reason for confidence that America can enter the new era with great universities and noble colleges reshaped and strengthened by 15 years of thoughtful self-examination and wise experimentation.

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EDUCATION, History of. The history of education begins with primitive man — in fact even with the lower animals, for any training which is given by one being to another to enable it to do something better than it would otherwise be able to do may be designated education. We might distinguish between the education which is given by animals, which is instinctive, and that which is given by human beings, which is partly instinctive and partly consciously and deliberately worked out into a system.

The earliest system, if it may be called such, that of primitive man, had, perhaps very much of it instinctively, as its end the object of teaching others, particularly the young, methods of protection from enemies and of obtaining food, clothing and shelter. In other words, savage education adapted itself to the immediate needs of life. To estimate how widely it extended itself along such lines one only has to think of the actually widely extended domain of savage activity; the making of arms, boats, clothing, huts, the manufacture of articles used in the catching and preparation of food, fishhooks, spears, traps and pottery of all sorts.

From the first times of which we know anything, considerable attention was given by primitive man to self-adornment, sometimes with a sex motive, at others with motives of protection and religious belief. The training given in making gaudy articles of decoration did not have that close relationship to the most immediate needs of life, and thus almost at the beginning of things education was unconsciously divided into training for the doing of those things which were useful and those which we may denominate as luxuries or superfluous — though where one merges into the other it is difficult to determine.

As man progressed from his extreme simplicity, and great industrial changes gradually took place, such as came with the domestication of animals and the discovery of agriculture, new things for which training or education was to be given arose. The more complex civilization has become, the more numerous have become the various elements for which the individuals have had to be trained, and thus every educational or training system should have adapted itself to the needs of the civilization in which it was existing. The natural conservatism of man has, however, as history shows, led him frequently to cling to an educational system adapted to earlier ages.

The influence of religion among all early peoples was so great that those of the community into whose hands the religious ceremonies gradually fell exercised an enormous influence. Training for their particular class became an end in itself and those who succeeded in becoming members not only determined the training which future entrants should have, but also by virtue of the peculiar influence of their profession succeeded in influencing all other training given — even for ends other than religion.

So powerful has been the influence of religion on education that beginning with the earliest people, of whose history we know much, the Egyptians, it continued to be the dominantly determining and usually reactionary and conservative factor right down through the middle of the 19th century, in a measure accounting for the fact that systems of education have so frequently lagged far behind the demands of civilization, and have given a training in one century of a sort adapted to a condition of man's development of some centuries before.

The earliest teachers were with primitive peoples the parents, and they continued to be a very large factor in all ages. The professional teacher, however, had already come into existence at the dawn of history in Egypt. The priests were the most important of them, though there were many private teachers for teaching practical trades and professions. The methods employed in teaching were those largely of mem-

orizing and imitation. Writing by the stylus on wood or with ink on papyrus was taught as was always reading and numbers. The discipline was severe, corporal punishment resorted to and the teacher held in respect.

Variations of the system in vogue among the Egyptians were to be found among the Chinese and Hindus. The Semitic peoples — the Babylonians, Assyrians, Hebrews, Phœnicians, showed less rigidity and fixity in their systems, probably due to less attention to caste in the social organization than was the case with the former peoples. The studies given were reading, writing, arithmetic, history, religion, psalms, domestic arts, music, dancing and trades. Law, ethics, astronomy and geography were studied by those who went above the ordinary trades and went into the professions. The teaching was dominated by the priests and they exercised a restraining influence on that breadth of education which might have come from bringing in Greek and Roman methods.

The history of Greek education extended over many centuries and during that time the educational system, beginning in Homeric times and closing with the Roman conquest, underwent many changes in ideals and content. Even over the period when the Greek world was supreme there were within its boundaries states that had very divergent systems of education. The two extremes are usually represented by Athens and Sparta and the difference between their educational ideals may be in a measure accounted for by differences in tribe and environment. The Athenians, sprung from the Ionians, were highly imaginative, artistic and literary. The Spartans, sprung from the Dorians, were lacking in imagination, were extremely practical and highly military. The former lived near the sea and in their maritime trade got a breadth of view and culture by trading with foreign nations, while the latter lived in the interior surrounded by their mountains, cut off from the broadening influence of contact with others. The educational ideal of the Athenians therefore came to be that of leading a complete life, beautifully and happily. The individual and his opinion were made much of. Ever with the idea of beauty in mind the young were taught grammar, poetry, style, oratory, rhetoric, music, mathematics, physics, economics and politics. The teachers, who were more or less free lances, overdeveloped themselves in their individualism and brought their pupils up to be unduly forward and disputatious and lacking in reverence for the state and religion.

In Sparta the ideal was to develop strength, courage and obedience — to subordinate the individual to the state. Much less stress was laid on the literary and the artistic. To accomplish this ideal the state was turned into a military school, and each citizen was trained accordingly. As the individual was not trained as such he was lacking in moral force.

It was from Athens rather than Sparta then that the first greatest teachers and writers on educational systems and theories came: Socrates, Xenophon, Plato and Aristotle, and probably no four men from any one people have exercised greater influence on educational history than these.

The Romans by nature were much more similar to the Spartans than to the Athenians. Their early educational work was very practical and centred in the home in which the father was the dominating and all-powerful factor. Training was thus given in the Laws of the Twelve Tables, in business, farming, civic duties, reading, writing and arithmetic. Girls received instruction in household duties.

After the conquest of the Greeks by the Romans the former began to exert a powerful influence on Roman education. Greek teachers came over in large numbers and the former purely practical education of the Romans began to take on a literary and artistic turn. The study of Greek prose and poetry was introduced even for the younger children, and in the higher schools training in history and science, philosophy, oratory, declamation and debate was given. Rome like Athens produced some profound students of education, the most important being Cicero, Seneca and Quintilian. Schools were multiplied and state support widely and generously given. With the incoming of the barbarian Teutonic hordes from the north and the disruption of the Roman Empire, the culture and the educational work of the Greeks and Romans largely disappeared. Education suffered a shock from which it did not recover for centuries and the world had in a way to begin all over again.

The Church assumed leadership not only in matters of religion but also in matters of state. For a time very little could be done about general education. As the ideal of life was ascetic and all things which pertained to man's life on this earth looked down upon, the education which was given was, in the ideal at least, to prepare men for the life to come. In the monasteries, where such teaching as was given was carried on, time was devoted to prayer and contemplation. The past was revered for its spiritual and religious teachings and books containing them were carefully copied. To this end largely the novices were taught reading, writing, singing, the church service and a little arithmetic. Then they were given the trivium (grammar, rhetoric and dialectic or logic) and the quadrivium (arithmetic, geometry, astronomy and music) which made up the Seven Liberal Arts.

Though some outside of the religious order might enjoy the privileges of this education, the chief object of all of this instruction was religious. Even the attempts of Charlemagne in his Palatine School under the headship of Alcuin could not make the educational ideal very different. After his death as during his life the only educated class was the clergy. The people generally and even the nobility received very little education in the ordinary acceptance of the term in ancient and modern times.

Such training of the noble classes as was given that might be called educational is to be described under the title of chivalry. A youth was trained as a page in attendance on a knight or lady, was given some instruction in music and poetry, and taught how to play chess. Later as a squire he was given military training and instruction in hunting, riding, jousting, swimming, religion and singing. As a knight he was taught ethics, to practise the virtues, to defend the Church and protect women. See CHIVALRY; ETHICS.

Out of the monastic schools there grew up a certain type of scholarship known as scholas-

ticism (q.v.), whose object was to use Greek knowledge for religious ends. Great stress was laid by its devotees on dialectics, the object of which study became not to discover new but to prove old truths. Aristotle and his works became to these students the chief source of knowledge.

During the 11th, 12th and 13th centuries there was a remarkable growth of cities, due to the activities of the artisan and commercial classes. These people were organized into trade and merchant guilds and it became the object of each guild to have its prospective members educated. The guilds employed teachers, usually drawn from the clergy, to give the children of members instruction in reading, writing, arithmetic. Even the cities as chartered bodies established schools for the same purposes. In each of the guilds there was a system of teaching boys a trade by the system of apprenticeship.

Toward the end of the 11th century and during the course of the 12th, universities began to grow. At first these were groups of students banded together for a common purpose, such as the study of medicine at Salerno or for law at Bologna. In Paris the university grew out of a school attached to the cathedral and was an organization of masters or teachers. The instruction there was at first mainly in theology. A university in our sense, with a large plant and numerous buildings, these were not. The students met for lectures in private houses or rented halls.

During the Middle Ages art, love of beauty, literature, poetry, science thrived as contributions to the support of religion and the Church. One important result of the Crusades (q.v.) was that they broadened men's minds, and subjects of study which had been formerly condemned because of the influence of the Church and the clergy came to be taught during the Renaissance. The study of the Greek and Latin languages for the knowledge of the literature and wealth of learning which the Greeks and Romans had was revived. The development of the individual became an object. The Church ceased to be everything and the men now thought of fame and glory for themselves. Teaching still remained in the hands of the clergy, but the subject matter of instruction was broadened. These Renaissance teachers in their turn fell into narrow ways and came to emphasize linguistic training to the exclusion of physical, social, artistic and scientific elements. Petrarch was such a teacher, whereas his fellow countryman, Vittorino da Feltre, emphasized history and civilization.

The Reformation and Counter-Reformation (qq.v.) brought about considerable changes in education as well as in religion. Luther and Melanchthon both demanded that education should be provided for all and that the state should maintain and control the schools and see that children attended them. Thus the idea of compulsory education was initiated. Stress was laid on teaching the vernacular, on providing simple instruction in the elementary schools to meet the immediate needs of the people. In the secondary schools, or Latin schools as they are called in England, instruction was given in the classics, history, mathematics, grammar, rhetoric, logic, music and gymnastics. Though in theory these schools were to supply leaders of thought, in practice they became preparatory schools for the universities, whose main object was the preparation of teachers and ministers. The liberalism in education which was at first promised by the Renaissance failed to materialize during the Reformation and education took on the form of supporting the various sects which had grown up after the revolt from Roman Catholicism. Corresponding to the Protestant schools were those of the Jesuits whose insistence on thoroughness and on well-trained teachers has become proverbial.

During the last half of the 16th and the whole of the 17th century this religious control and formalism dominated education. In content the curriculum was humanistic, but in spirit it was almost as ascetic and scholastic as in the Middle Ages.

This kind of education met with protests from certain scholars like Rabelais, Milton, Montaigne and Sir Francis Bacon, who have been denominated realists because they insisted on the study of thought and substance in literature, instead of the words and grammar, and on the study of nature, law, arts and trades by means of actual observation. The curriculum of studies, however, still remained literary and linguistic and this met with little opposition. The object of its supporters came to be to justify it and this they did through the theory of formal discipline, so well enunciated by the Englishman, John Locke. According to him it is not so much what is learned as how it is learned. The value to the pupil is in the discipline obtained in the process of learning.

The stiffness and formalism which had held sway in religion and education for so many centuries led, in the 18th, to a revolt best illustrated by Rousseau. His was a cry "back to nature" — to doing things in a natural way — to permitting the development of a child according to its nature.

The influence of Rousseau was not immediate, but it left an indelible impression on the educational progress of the 19th century. Formalism gradually gave way to a natural treatment of the child and training was adapted to age and individuality. Following him came: Pestalozzi, who preached that in order to give proper education the psychology of the pupil taught must be studied and his needs, interests and abilities taken into consideration; Herbart, who emphasized the importance of education as a science and of the proper training of teachers to teach; Froebel, who was responsible for the establishment of the kindergarten and the development of the ideas that self-activity, initiative and individuality are important ends of education.

In the 19th century there has been a steady if slow development toward the theory that the proper education is that which enables the student to turn that which he acquires by learning to immediate use — that mental power is best developed by learning those things which are of most use in life. Herbert Spencer was the best exponent of this "turn to use" education. Children should be taught those subjects which will enable them to earn a livelihood and be good citizens. His influence was responsible for bringing science into the school curricula and for an attack on the formal discipline theories of Locke.

Down to the 19th century education had been generally considered from the point of view of the individual. The great growth in industries and in democracy during that century emphasized the need of educational systems which should take into consideration the position of the individual in society. The individual must be educated mentally, physically and morally, and he must be trained for the professions, or the trades, or in agriculture or commerce, for if he is not he will in a way be a drag on society and the body politic. For such an education all means known must be placed at the disposal of the child and citizen: schools, elementary and secondary, manual and vocational, colleges, academic and technical. Nor is the question as to whether the individual shall take the education one for voluntary action. Society has the power and the right to compel him to get an education.

To justify its place in the curriculum a study must be shown to have some immediate and practical relation to life. In the first quarter of the 20th century a visit to our schools and colleges shows the extremely practical turn which education has taken. In addition to instruction in the mother tongue, reading, writing, arithmetic, geography, history and other subjects familiar in earlier centuries, are to be found an array of such subjects as woodwork, ironwork, cooking, sewing, printing, drawing, architecture, engineering of all kinds, agriculture, horticulture, forestry, dairying, bookkeeping, business practice, civics, commercial law, stenography, typewriting, economics, banking, finance, transportation, insurance, sociology, carpentry, blacksmithing, molding, plumbing, machine-shop work, bricklaying, plastering, textile industries and many others. Thus the authorities in charge of public schools and universities have taken over many studies formerly left to private employers or agencies, and now by the establishment of playgrounds, nurseries, recreation centres, camps and many other activities are tending toward a control by the state in the interest of society which is cramping the freedom of action by the individual. The latest innovation advocated along such lines is that of compulsory military training in a democracy like the United States. This has been brought about by the Great War which began in 1914. How far this sociological method in education will go only the future can tell. See EDUCATION, THEOLOGICAL; RELIGIOUS EDUCATION IN THE UNITED STATES; EDUCATION, NATIONAL SYSTEMS OF; and related subjects.

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EDUCATION, Indian. See INDIAN, EDUCATION OF.

EDUCATION, Industrial. Industrial education aims directly at training men and women, both youths above 14 years of age and adults, for progressively intelligent, skilful and economic production of food, clothing luxuries, machinery, structures and all the conveniences of life. It is distinguished from ordinary elementary or secondary education and from technical education by the fact that its purposes and methods are primarily dictated by the need for increased production through developed skill and experience, rather than by a desire to add breadth or culture to the future citizen and producer. Its organization in the United States is very recent and still incomplete and unsystematized.

In a century the United States has changed from a country of less than 10,000,000 people, essentially agricultural, in 1820, to a complex industrial and agricultural nation of 110,000,000, with unmeasured resources. With the development of a complicated factory system of production, machines took the place of much skilled hand labor, and the old apprentice system for training workers broke down. The substitution of school instruction for the former shop methods of training young workers in this country grew up slowly and uncertainly, lagging far behind European provisions for industrial training. The demand for some form of industrial education was expressed very early in the period of the "industrial revolution" in the United States, in fact before the end of the first quarter of the 19th century. But up to 1860 not more than four schools were giving instruction in applied science and two in agriculture. (See EDUCATION, AGRICULTURAL). The movement which led to the founding of Rensselaer Polytechnic Institute (q.v.) in 1824 was later supplemented by the beginnings of agricultural education in the foundation of institutions like the Michigan Agricultural College (1857) and the "Illinois Industrial University" (now the University of Illinois). The latter was the result of agitations of the Illinois Industrial League between 1850 and 1860 for the purpose of "bringing education home to the people of the State — the great industrial classes" or, in more concise terms, to produce "thinking laborers" rather than "laborious thinkers." The passage of the great Morrill act in 1862, which stands to-day as the most important Federal legislation affecting education, provided Federal aid to the States "for the endowment, support and maintenance of at least one college whose leading object shall be . . . to teach such branches of learning as are related to agriculture and the mechanic arts . . . in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life," and gave the movement for industrial and technical education its greatest impetus.

While nearly all of the 51 institutions, not exclusively for colored students, which receive aid as land grant colleges, started with the idea of preparing young men and women for agricultural and mechanical industries, they developed, during the 30 years between 1870 and 1900, into technical, rather than industrial, institutions training men for engineering or technological professions. On the other hand the 16 institutions exclusively for colored

students still devote their energies mainly to literary instruction and to training in both agriculture and the mechanic arts and not at all to technical education.

Along with this evolution of the aim and organization of the land grant institutions, many experiments in industrial education for both men and women were tried in a great variety of schools and courses which were designed to fit students for immediate betterment of their condition as wage earners and independent producers. Both technical and industrial types of education were at first considered as competitors with the general or liberalizing education of the elementary or secondary schools; both suffered from the lack of specially trained teachers and of a body of organized and tested materials for instruction. The necessity for using teachers trained in the old order caused many a failure but ultimately both types have been recognized as auxiliaries or supplements, not rivals, to the older types of schools and both now receive liberal support on the same basis, namely, the common differentiated service of the whole community in the promotion of an industrial efficiency in America equal to the best in Europe without class distinction and without closing the door of opportunity to any student.

The centennial exhibition of 1876, especially the Russian exhibit, stimulated the introduction of manual training or manual arts into the elementary and secondary public schools of the United States. (See MANUAL TRAINING). The object of this form of education, however, was not the production of marketable material, but the training of the pupil's hand and eye, as well as his brain, as vitally related to his full personal development. But the demands of the industries in a rapidly expanding, competitive order, which was no longer provided with an apprenticeship system, could not be met by this form of training, and institutions sprang up to provide various forms of special training for vocations like agriculture, carpentry, cooking, iron-working, machine work, painting, plumbing and stenography. By 1900, 144 manual and industrial training schools reported to the United States Bureau of Education from 38 States and Territories showing 41,736 pupils under instruction. From 1900 to 1917 the number of schools devoted primarily to industrial and trade education greatly increased, both through tax-support and through private foundation on a generous scale, for example, the Dunwoody bequest of approximately $3,000,000 for the Dunwoody Institute for free instruction in industrial and mechanic arts for the youth of Minneapolis and Minnesota, a worthy successor in the long line in which Girard College (q.v.) was a pioneer. In 1917 public and private high schools to the number of 2,610 reported 130,734 students in technical and manual training courses. Three thousand five hundred and ninety schools reported 260,413 students in commercial courses and 145,727 students in courses in domestic economy. In the same year, 912 private commercial schools or business colleges enrolled 192,388 students.

The following courses of instruction in Wentworth Institute opened in Boston in 1911 as a purely industrial, endowed school "for the purpose of furnishing education in the mechanical arts," will illustrate the scope and method of an extremely and immediately practical type of industrial education confined to building and manufacturing and to printing and graphic arts. Admission to the one-year day course is open to students "at least 16 years of age . . . *thoroughly in earnest*"; to the two-year day courses, to those who pass examinations in arithmetic and English. One-year day courses are offered in carpentry and building, electric-wiring, plumbing, machine-work, pattern-making, foundry practice, forging, hardening and tempering. The weekly schedules for three terms in the course in machine-work calls for 20 hours of shop practice in machine-tool work, machine construction, bench-work and tool-making; 6 hours of mechanical drafting and blue-print reading; 9 hours of practical mechanics, materials of construction, power transmission, etc.; 5 hours of practical mathematics, machine shop computations. The two-year day courses are for persons who wish to become master mechanics, foremen, etc., and provide instruction in machine construction and tool design, electrical construction, steam and electrical power plant practice, foundry management and operation, and architectural construction. Evening shop courses are provided for persons employed during the day, and are selected from the list just given, together with tool-making, foundry chemistry and advanced plumbing; evening technical courses are for persons employed in building and manufacturing industries and give instruction in practical mathematics, mechanical drawing, machine design, architectural drawing, architectural design, practical mechanics, reinforced concrete and modern fireproof building, applied electricity, care and operation of steam boilers and engineering. There are also day and evening courses in printing and graphic arts, including typographic printing and composition, block printing and etching. Similarly detailed curricula would be found in specialized schools in cities like Lowell, Mass., where textile industries predominate, and Scranton, Pa., in the mining region.

Another form of industrial education is found in the 101 State industrial schools, which reported in 1916 36,976 males and 9,567 female students learning some trade or occupation. Of the type wholly supported by the State are the Iowa Industrial School for Boys and the New Jersey State Home for Boys; of the co-operative type, privately managed but subsidized by the State, for the care and instruction of orphans and delinquents, is the Roman Catholic Home of the Good Shepherd in New York, in which girls are prepared for various occupations.

Still another important group of schools for industrial education is that for special groups or races, as schools for negroes and Indians. The increase of industrial facilities in colored schools, however, has not been equal to that in white institutions. Among the most notable of these industrial schools is the Hampton Normal and Agricultural Institute of Virginia, opened in 1868 under the great leadership of Gen. S. C. Armstrong for training of negroes in academic, industrial and agricultural subjects. The institution has national recognition "as a pioneer in

the development of the educational value of manual labor and in the correlation of academic subjects with industrial training." An offshoot or imitator is the Tuskegee Normal and Industrial Institute of Alabama (q.v.), built up, under the leadership of Booker T. Washington, from nothing to a plant and endowment worth $4,000,000, an attendance of nearly 1,400, and a teaching staff, all colored, of 184. These two have been followed in some degree by the 16 land grant schools for negroes and by more than 200 smaller institutions scattered all over the South. One hundred and sixty-three counties in Southern States provide county industrial teachers. Washington, D. C., Charleston, S. C. and Columbus, Ga., are the only cities which maintain industrial schools for negroes. Important among the 109 boarding schools under Federal management, for the general and industrial education of Indians, are the Indian Industrial School of Carlisle, Pa., The Haskell Institute of Lawrence, Kan., and Sherman Institute, Riverside, Cal., in all of which the industrial element is kept strongly predominant.

Other forms of industrial education in process of organization and standardization are the special schools, continuation schools and corporation schools for workers in service. The motto of these schools is "Learn while earning, and earn while learning." They are conducted as day schools, evening schools or correspondence schools, frequently as parts of the public school system of cities, and have for their four objects (1) the advancement of the individual by special training for more technical work, (2) the prolongation of the period of education for those who would otherwise not go to school at all, (3) the increased efficiency of the student in his present position, (4), the discovery for each student of the kind of work for which he is best fitted. The lower age limit for all of these schools is 14 years. The co-operation between school and employer takes varying forms. In some instances the student is detailed from his regular task to the school for certain hours on his employer's time; in other cases instruction is in the shop with the aid of a paid instructor in addition to the shop superintendent. In still others like the recent "vestibule schools" the employee is intensively trained for a brief period before admission to the regular service of the employer. Twenty-four big corporations in 1917 had special training schools for men in preparation for service of the corporation, the largest of these schools being that of the General Electric Company, which admits 250 to 300 college men per year for a training period of 12 to 15 months. In a similar manner the American Bridge Company receives about 60 college men per year for a course in bridge engineering from one to two years in length. The Boardman Apprentice Shops, part of the public school system of New Haven, Conn., provides industrial education in co-operation with corporations in that city on a plan providing for eight hours of instruction per day, 5½ days per week, and 50 weeks of the year for a two-year period, approximately one-quarter time being devoted to academic subjects and three-quarters to actual trade practice under the instruction of skilled mechanics for the production of salable articles. In some cases in this school, as in others, the boys in pairs alternate between school and the factory in which they are employed, one working in the factory while the other is in school. The significance of this form of industrial education is attested by the formation of the National Association of Corporation Schools in 1913, which had in 1917 104 company members, including such corporations as the Atchison, Topeka and Santa Fe Railway, which reported 37 railway shop schools for apprentices; the American Telephone and Telegraph Company and the International Harvester Company.

The incorporation of industrial or vocational education into the State systems, with provision for State subsidies to vocational or industrial schools, had been provided for in 10 States in 1916: Massachusetts (Department of Vocational Education), New York (Division of Agricultural and Industrial Education), Connecticut (State Superintendent of Trade Education), Pennsylvania, Wisconsin, New Jersey, Indiana, California, New Mexico and Maine.

The movement for industrial education received its greatest recent reinforcement in the passage of the so-called Smith-Hughes Act of Congress, 23 Feb. 1917 "to provide for the promotion of vocational education; to provide for co-operation with the States in promotion of such education in agriculture and the trades and industries; to provide for co-operation with the States in the preparation of teachers of vocational subjects," which made an initial appropriation in 1917 of $1,860,000 to be gradually increased to an annual grant of $7,367,000 after 1926. The allotments to the States for the various purposes of the act are made in the proportion which the rural, urban and total population of each State bears to the corresponding totals for the United States, the allotments to be administered through State boards in accordance with plans approved by the Federal Board for Vocational Education.

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EDUCATION, Junior High School. See JUNIOR HIGH SCHOOL.

EDUCATION, Kindergarten. See KINDERGARTEN.

EDUCATION, Medical. See MEDICAL EDUCATION.

EDUCATION, Moral. Instruction in morals, whether merely informally by parents or formally by teachers, dates from earliest antiquity. This is true largely because of the nature of the subject, for morals, strictly defined, comprise as subjects the customs (Latin *mores*), laws and precepts which have grown up among a tribe, people or race.

Out of this kind of moral instruction grew another which went beyond a content which had only included those things as moral which were customary. This new kind of teaching questioned certain moral standards which had grown up and, taking a more advanced ground than that which made mere custom determine a moral standard, declared that certain rules of conduct should be followed because they were better than custom. The determination of what was better was generally arrived at by the experience of realizing that a condemned custom was detrimental to general physical or mental welfare.

Moral instruction along this higher plane became most prominent among the Hebrews and the Greeks, was carried on by the Romans and has continued down to our own day.

It was quite natural that from earliest times moral instruction should become closely interwoven with religion and the clergy. The latter as a class were the preservers of custom and the speculative philosophers on improvement. Great moral teachers other than the clergy did arise and brought about what were sometimes considered great revolutions in moral ideals, but generally throughout ancient and mediæval times the dominating importance of religion and the priesthood made the religious organization the determining factor in moral instruction. Particularly in the Middle Ages the close association of education with ecclesiastical institutions made the clergy the almost sole teachers of morals.

Beginning with the Renaissance and the Reformation there began to grow almost imperceptibly and very gradually a separation between religion and education which has culminated in their practically absolute divorce in the public schools of France and the United States. In the course of this long movement moral instruction largely remained in the hands of the churches, as those in control of state-supported schools felt that because of the variety of religious sects no form of religion should be taught. The close connection hitherto existing between the teaching of religion and the teaching of morals, and a feeling that the two were difficult to separate, were probably responsible for permitting the teaching of morals to drop out of state-supported institutions.

In countries like England and Prussia, where the church and state maintained and still maintain a close relationship, and the public schools are still strongly under the religious influence of the Church, moral instruction was continued. The tendency to drop it from the state-supported schools of the former country led in 1906 to the formation of the Committee on Moral Instruction and Training in Schools for work both in the United Kingdom and in the United States.

In France the government in 1882 put into operation a course of study in morals for use in the public schools. In the United States the Religious Education Association, organized in 1903, has begun an agitation for the introduction of moral instruction in the public schools and its efforts have been seconded by a recently established (1911) National Institution for Moral Instruction with headquarters at Washington, D. C.

These movements in the United States have had particular reference to the public schools. Schools, conducted by or in conjunction with churches or religious sects, and ethical culture societies, and many, though not all, private schools, consciously attempt to give moral instruction. The colleges, generally speaking, the public elementary and the public high schools, do little or nothing in an avowedly formal way with moral instruction.

The problem presents great difficulties particularly in the United States. The heterogeneous character of the school population, comprising as it does children from scores of different peoples foreign to each other in language, religion, institutions and moral ideals, makes it extremely difficult to get a common meeting ground. A course of study in morals comparatively easy to carry out in a New England or Southern village, where all of the people are of a common ancestry for generations, encounters unexpected difficulties in New York city. A course now used in France, for example, can, in some particulars, be shown to be ill adapted to the United States.

Again, the teachers, though all agreed that something along the lines of moral instruction ought to be done, are in no agreement at all as to how it should be done. Those who believe that formal lessons in morals with a definite allotment of school time ought not to be given seem to be in a majority. They feel that some suggestive course of study ought to be drawn up so that teachers would be enabled to give training in character and morals in conjunction with the studies already in the curriculum, particularly those of English, history and civics. They feel, however, that each study may be made to answer the purpose, when skilfully and deftly handled, and that everything in connection with school life should be utilized: the playground, sports, the assembly, the school city, self-government, dramatics, pageants, home visits, parents' meetings, etc. They lay emphasis on the personality of the teacher and on the necessity that normal schools and other teacher training agencies are under, to develop teachers who will exercise a good influence on pupils by their personality, spirit and example. They also urge that those who employ teachers should place the element of personality more strongly to the fore than formerly.

The teaching body as a whole may be said to be passive with reference to moral instruction. Though perhaps acknowledging its worth they are willing to do nothing active to bring it into the course of study. Some meetings of the National Education Association (1907 and after) have had papers read upon it and they have met with a favorable reception. In some communities the courses of study in the elementary schools point out the opportunity for giving moral instruction, but this is not general.

A considerable negative element is found which doubts the utility of moral instruction. Members of this group maintain that it cannot be shown that the moral condition of the people in countries where religious and moral instruction is given is any higher than in the United States. They say that it cannot be shown that the graduates of church and private schools, where more or less formal moral instruction is given, are superior to those of

the public schools, where virtually no or very informal instruction is found. They maintain that it is only through the personal influence of the teacher that good results are obtained and that all efforts should be directed toward the preparation of the teachers. They seem to overlook, however, the fact that the teacher is an outgrowth of the boy or girl, and that to get effective teachers a system of moral instruction for the children is necessary, as the pupil of to-day is the teacher of to-morrow. In spite of this negative attitude on the part of some the outlook at present is that courses of study for morals and character building will have a great growth in the future. See ETHICS; and related topics on EDUCATION.

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EDUCATION, National Systems of. The system of education maintained by any nation must be the result of three groups of factors; (1) a group of national ideals; (2) a group of fundamental conceptions of the relationships of citizens in their economic, political, social and religious activities, and (3) an accepted attitude toward childhood and a group of accepted views with reference to the nature of educational processes. All of these may be vague and ill defined or they may be clearly formulated,— the result of a philosophy of life, consciously worked out in a more or less scientific way. The first two groups of factors are most influential in determining a nation's educational aim and in guiding the selection of the content, or material to be taught; the second and third groups contribute most to the form of organization perfected for carrying on educational work; to the third group we look for the explanation of the methods of instruction employed. In order to fully understand a nation's education, then, there must be taken into account facts with reference to its history, industrial life, government — particularly in its legislative and administrative phases — temperament of the people, organization of society, religion, and, finally, the degree to which scientific principles have been developed and applied to problems of education.

Such completeness is impossible here. With these facts in mind, however, we may in a general way characterize the leading national educational systems of the present by presenting their most prominent characteristics and indicating the conditions upon which they depend. France, Germany and Great Britain, because of their size and importance, deserve the fullest treatment. We shall treat them first, following with very brief sketches of other European nations, then of the two principal nations of the far east, China and Japan, and finally, of Latin-American countries.

France.— France possesses a national system of education in the truest sense. Its most marked characteristic is centralization. Politically, the country is made up of 89 "departments," each under a prefect appointed by the President, a small advisory council and a general council of elected members. Each department is divided and subdivided again into "arrondissements," "cantons" and "communes." For educational purposes the country is marked off into 17 "academics." The authorities in all these divisions, both political and educational, play a part in carrying into effect the educational laws, all of which are national. Some of the characteristics of the system resulting from these laws are (1) opportunity for free elementary education: (2) compulsory attendance; (3) absence of religious instruction in public schools; (4) required instruction in morals; (5) a completely organized system of normal schools; (6) recognition of teaching as State service and provision for teachers' pensions.

Administration centres in a government department under a Minister of Public Instruction. Assisting him are four directors; one each for elementary, secondary and higher education and one for accounts, under each of whom are a number of bureaus with special functions. In each academy except Paris a rector has charge of educational affairs in general, though prefects hire elementary teachers on recommendation of academy inspectors, and certain other affairs are left to a departmental council of teachers, inspectors and general councillors. In the academy of Paris the Minister is nominally rector, but a vice-rector performs the duties of the office. Inspection of the system is organized to the last detail. For example, in case of primary education there are general, academy, departmental and arrondissement inspectors, each of whom must possess special qualifications.

Instruction may begin at a very early age in the maternal schools (*écoles maternelles*), where children from two to six years of age attend. Infant classes for children from five to seven years are provided in some places. Schools of primary and secondary grade are not closely co-ordinated. The former are practical and are directed toward life work; the latter (the *lycées* and *collèges*) are pointed more in the direction of higher training.

Lower primary schools, adapted to fit the compulsory school period (ages 6 to 13), are organized wherever possible as elementary, intermediate, and higher grades. The fundamental elementary subjects are taught, stress is put upon manual work, and the teaching of morals is compulsory. Special classes are organized in many places for backward and subnormal children. Where necessity warrants it, books, pencils and even food are provided. Supplementing the primary instruction described above are various courses. There are: (1) the "supplementary courses" (*cours complémentaire*) provided in some places; (2) the "higher primary school," which is a separate school with a practical course; (3) profes-

sional schools offering special instruction, as agriculture; and (4) continuation schools which are somewhat similar to the evening classes in American cities.

A normal school for each sex in each department, except where departments are allowed to combine their efforts, provides a three-year course for training elementary teachers. The work includes theoretical pedagogy and practice teaching. A higher normal for men and one for women are provided for the preparation of teachers to supply the departmental normals.

Secondary instruction is given in the state institutions called lycées, and in the communal collèges, which may receive state aid. Both may charge tuition fees. They admit boys at the age of 10 or 11 years and give courses of seven years. Most have preparatory schools for boys under 10 associated with them, so they do not draw their attendance, ordinarily, from the primary schools. The first "cycle" of four years is arranged to allow a choice of a classical course or a modern language and science course. The second "cycle" of three years offers four possibilities: (1) a Greek-Latin; (2) a Latin-modern language; (3) a Latin-science, and (4) a science-modern language course. Completion of any course of the four gives a baccalaureate degree. Teachers in these institutions must have special training along both academic and pedagogical lines. Secondary instruction for girls is carried on in lycées and collèges for girls, but the course is of five years instead of seven. They too have their own preparatory schools.

For higher education a university has been established in each of 15 of the academies, but they do not all have the complete four faculties. Appropriate degrees for higher work are given in the name of the state. There are also some special institutions, among which are the Collège de France, which dates from 1530, certain private institutions, and some "free faculties" of the Roman Catholic Church. Private institutions may not take the name of university.

Great Britain and Ireland.— England, Scotland and Ireland may best be treated in a group because all are more or less directly under the control of Parliament and all receive contributions from parliamentary money grants. Let us take them up in the order given above.

England's education is best understood when approached from the historical viewpoint. Its organization has been slow and only in recent times has begun to warrant the use of the term "system." The leading universities and some of the secondary schools are several centuries old, and still maintain curricula which suggest the Renaissance. They have always been the fitting schools for the best classes of English society. For a long period the education of the common people was, in accordance with accepted views, the business of the Church. Schools were controlled by ecclesiastical authorities. Two or three centuries of change along industrial, social and political lines, however, brought a change of view. Education began to be thought of as the business of the state, as is shown by various bills presented in the Parliament, appropriations and the appointment of a special committee for administering educational grants. But the first of a series of really effective measures was the educational act of 1870.

Under this act, existing voluntarily established denominational schools were to be recognized as public elementary schools and receive apportionments from parliamentary grants on condition that they (1) conform with regulations of the education department, (2) submit to government inspection, and (3) reserve religious instruction for hours outside those of the regular school day. They might charge fees but could not share in any local tax. The act provided further for a school in every district not already supplied, provided the electors requested it. Such a school was to be established by a local elective school board, and came to be designated a "board school." It might, on meeting government requirements, receive support from both parliamentary grants and local taxes. Thus was laid the foundation upon which has been built England's dual system of schools, supported by moneys from fees, endowment incomes, parliamentary grants and local taxes. A summary of some of the most important characteristics resulting from legislation since 1870 would include (1) compulsory attendance; (2) abolition of fees for elementary instruction and provisions for free tuition; (3) the right of voluntary (denominational) schools to participate in local tax funds; (4) abolition of the old committee and organization of a central board of education; (5) elimination of local boards and placing of local school affairs in the hands of the "county councils"; (6) extension of government support and inspection to include secondary schools of all classes. Government schools are now called "provided" schools, while others are called "nonprovided" schools. Supervision is left to supervisory boards, and in case of "nonprovided" schools a majority of the members may represent the Church under which the schools were established. Secularization is therefore not complete.

In the elementary schools, the lower grades, or "infant schools," for children of five or less to eight years of age, lead up from play exercises to easy reading, writing and number work. Upper grades, for ages 8 to 15, carry work in the usual elementary subjects. Additional classes for vocational training may be organized under certain conditions. Where a need for them exists, "higher elementary schools" of three grades may be established for the continuance of instruction along the lines of elementary subjects with special vocational training added. Children who attend must be 12 years old and must have completed at least two years of elementary school work. They may not remain after completing the third year of the course nor after attaining the age of 16, except to complete a grade.

Technically, among secondary schools are included all day and boarding schools maintaining courses of wider scope and more advanced degree than elementary schools and attended by scholars up to and beyond the age of 16. Pupils may enter as early as the age of eight or nine. These schools may charge fees but also receive parliamentary aid on meeting government requirements. Breadth of training is insisted upon and Latin may be omitted from the course only with the consent of the school board. Considerable variation in organization

and means of support exists. The best known types are the classical "grammar schools" and "public schools," many of which rest upon very old endowments. ("Public school" does not mean free to the public. It is the designation for secondary boarding schools like Rugby, Harrow, etc.). These schools fit boys from the best classes of society for the university. Secondary schools for girls are very modern institutions. During the last few decades many have been established with financial foundations and study courses similar to those in institutions for boys.

Elementary and secondary schools are not closely co-ordinated. Most children who attend the broader secondary schools prepare under tutors or in special preparatory schools, then enter at an early age. Some pupils go from elementary to the secondary schools, but the number is small, and there has been official expression of the opinion that preparation in elementary schools for transition to the secondary is a "subsidiary object." When made, the transition should be early, not at the end of the course. That is to say, the two groups of schools differ in aim and are designed to meet the needs of different classes of society. Most children who go through and beyond the elementary schools enter day or evening continuation schools or vocational or technical schools.

Universities, university colleges and higher technical and professional schools provide for advanced training. They are not free institutions, but may receive government financial aid.

Teachers in secondary schools usually come from the universities. Elementary teachers get their training through a kind of apprenticeship known as "pupil teacher training," or by a method of "student teacher training" in which secondary training to the age of 16 or 17 is followed by a year of practical work and one to four years in teacher training colleges which are maintained in connection with universities or may be established by county or city councils.

Scotland's education is under supervision of a separate board of education, with committees for secondary education in large educational districts and local elective school boards. Elementary education is generally free. Compulsory attendance is demanded of children between the ages of 5 and 14. Practically all types of schools may receive parliamentary aid on compliance with government standards.

Primary schools (infant, junior and senior divisions) carry the child to the age of 12, when a "qualifying examination" is given. Beyond this he may enter a supplementary course or he may begin an intermediate course. The latter is a kind of lower secondary course of three years, broader in scope than the primary and including a foreign language. On completing it a child receives an intermediate certificate. A secondary school parallels the intermediate course and adds two more years, and may give a choice of more than one course. On completing such a course a child receives a "leaving certificate." Higher training is given in the universities and technical institutions.

Teachers prepare under the direction of committees for the training of teachers, of which there are four, and must take work in both academic and professional subjects, usually in selected institutions, not in separate normal schools.

The educational history of Ireland is similar in some respects to that of England. A group of voluntary elementary schools has been placed under control of a National Board, which administers education, supervises inspection of schools and distributes parliamentary grants of money. Elementary education is free and compulsory. Religious teaching is permitted, but may not be enforced by any denomination upon a child against the wishes of his parents. Teacher training is provided for in denominational colleges. Little progress has been made in providing higher elementary schools. Most secondary schools, known in Ireland as intermediate schools, are endowed, private or denominational. These have been brought partly under supervision of an intermediate board, which cares for distribution of grants of money to those schools which conform with government standards and submit to inspection. Denominational contentions have retarded the progress of higher education. However, there are a number of denominational colleges, and reorganizations of rather recent origin have resulted in the combination of some colleges into universities with a view to securing greater financial aid from parliamentary appropriations.

Germany.— Germany is a federation of some 25 states, in which are included monarchies, grand duchies, duchies, free city republics and small principalities. The King of Prussia holds the title of Emperor. Imperial legislation covers only affairs with which the states are jointly concerned. Other affairs,— and education is included among them,— have been left largely to the control of individual states. Education is sometimes affected by actions of imperial authorities, but there has never been an imperial educational code. There has therefore been no "system" of education in the empire, but systems, provided and administered by the several states, with consequent lack of uniformity in methods of providing and supporting schools. On the other hand, there has been similarity though not identity of educational aims; other states have tended to follow the example of Prussia; and since the historical background has been nearly the same for all, their schools bear remarkable similarities of content and organization and serve the various classes of society in much the same way.

Some states have series of educational laws, others only general legislative provisions supplemented by ordinances or decrees of central authorities. Administration has been highly centralized, particularly in Prussia. Most of the larger states combine education with religion under one ministry. This is true in Prussia, Bavaria, Würtemberg and Saxony. Some others include education in the Interior or in the Department of Justice. Central authorities may be assisted by local bodies, sometimes civil authorities, sometimes special provincial and local school councils.

Military training is universal, but the requirement decreases with increase in educational accomplishment. School attendance is compulsory, usually to the age of 14. Religion is taught in elementary schools. Much has been

done to raise efficiency of teaching and to induce persons to make it a life work. Pensions for aged teachers are common. Great progress has been made along the lines of hygiene and the sanitation of school buildings.

As stated, schools are similarly organized in the several states, though there are variations. Those of Prussia come nearest to being typical, and may be briefly characterized as follows: A longitudinal separation prevents continuity and keeps distinct the schools patronized by different classes of society. A child's school and the length of his course is determined almost entirely by the class of society into which he is born. Transition, after the first two or three years, is very difficult.

The "Volkschule," or people's school, is a free school of eight grades admitting children at the age of six, in which are taught the elementary subjects and religion. It is patronized by the lower classes of society. Most children go from here into industrial life. Supplementary courses in evening or Sunday "continuation schools" exist in many places, and there has been a movement in the direction of making attendance a requirement, up to the age of 18, wherever possible. Teacher training is thorough, including three years in preparatory classes above the Volkschule, three in a normal school, and then practical work, aside from the passing of various examinations.

Secondary institutions are tuition schools of nine grades, or classes, admitting boys (girls very rarely) at the age of nine or 10 years. Preparation for entrance is either privately or in a special preparatory "Vorschule." There are three types: (1) the "Gymnasium," characterized by its strictly classical course; (2) the "Realgymnasium," with a Latin — modern language — science course; and (3) the "Oberrealschule," with a science — modern language course. A special examination at the close of the gymnasial course (the *Abiturientenpruefung*), if successfully passed, fulfils the requirements for entrance to the university, in part the requirements for state service, and in addition secures certain privileges with reference to army service. The same is true for the courses in the "Realgymnasium" and "Oberrealschule," except that language deficiencies must be made up in order to enter certain university courses. Communities unable to maintain nine-year courses have six-year courses, paralleling the first six years of the schools just described, under the names, "Progymnasium," "Realprogymnasium," and "Realschule." Secondary schools for girls, similar in organization to those for boys, but with less extensive courses, are found in many places. Secondary schools are patronized only by the aristocracy and the professional classes. Secondary school teachers must have thorough training, including university work and special pedagogical training, both theoretical and practical.

Between the lower and the secondary schools are the "middle schools," with courses somewhat longer than that of the lower, or people's school. They are somewhat exclusive, charge tuition and are attended by children of the middle classes. But they do not articulate with the secondary schools.

Universities and higher technical institutions are state institutions, controlled by the state and maintained largely by state funds.

Austria and Hungary.— The educational systems in these countries are very similar to those of the larger German states. Hungary has included denominational schools under an arrangement similar to that in England, but in both these countries the organization of classes and the curricula in elementary, secondary and higher institutions parallel very closely those in the schools of Germany.

Denmark.— Administration of schools in Denmark is in the hands of the Minister of Ecclesiastical and Educational Affairs, with a school council in each county and a school board in each local subdivision. There is also a group of inspectors, assisted by the bishops of the state (Evangelical Lutheran) church. Education is free and compulsory between ages seven and 14 years. Religion is taught.

The school system includes (1) the elementary school ("Folkeskole") for children of six to 14 years, supplemented by continuation schools; (2) the middle school ("Mellemskole"), with a four-year course which may be entered from the elementary school after the age of 11, and supplemented by a "real class" leading into a group of "middle professional schools"; (3) the three-year "Gymnasium," offering three courses based on the classics, mathematics and modern languages, and leading to the higher technological schools and the university. The university is considered a part of the state system. Schools above the elementary are not free. Middle and secondary schools for girls exist, but they are fewer than those for boys. Normal schools, both public and private, give courses of from one to three years for the training of elementary teachers. Teachers are considered as in state service, and teachers' pensions are provided on a graded scale. Denmark deserves the credit for originating the special supplementary school for adults known as the "people's high school." It gives a short course, for men in winter, for women in summer, for which a tuition fee is charged, but there are no examination requirements.

Sweden.— Education in Sweden is controlled through the ecclesiastical department of the government, working in co-operation with the popular assembly.

Elementary education is compulsory for children from seven to 14 years of age. Schools are subdivided into "infant schools" (ages 7 to 9, and elementary schools (ages 9 to 14). Teachers are prepared in training colleges with four-year courses. Continuation schools, held usually in the evenings, "higher elementary schools" and "people's high schools," modeled after those of Denmark, supplement the elementary schools.

Secondary institutions are (1) the practical six-year "realschool"; (2) the four-year "gymnasium" for boys, offering both classical and modern courses; (3) the higher girls' school, usually a private school with preparatory classes attached; (4) the special technical school. A lower secondary examination is given at the close of the realschool course, and a higher secondary examination at the close of the gymnasium course. Children may go from elementary to realschool, also from this to the gymnasium at the end of the fifth year of the course. "Middle schools," in some communities, give a practical four-year course which

may include the work of the higher elementary school.

Three state universities and two private universities, known as high schools, provide for higher training.

Norway.— In Norway schools are under general control of the Department of Education and Ecclesiastical Affairs, but much control is left to county and local school boards in which the state (Lutheran) church is well represented. Primary education is free and compulsory to the age of 14 and religious instruction is required. A well co-ordinated system allows continuous progress from primary school through, first, a lower secondary school of four classes ("Middelskole"), and a higher secondary school of three classes ("Gymnasium"), to a higher professional school or a university. Secondary schools may be state, municipal or private. Most of them are coeducational. Continuation schools supplement the primary schools. Lower secondary courses articulate with technical courses of lower professional schools. Training colleges are provided for preparation of teachers. A number of special state institutions provide for abandoned and delinquent children and for defectives.

Netherlands.— Administration here is under the Minister of the Interior, under whom are ranged groups of general, district and arrondissement inspectors. Some local affairs are regulated by local civil authorities and communal school boards.

Classed as elementary schools are: day schools for children 7 to 13 years old — the compulsory school age,— continuation schools and evening schools.

Secondary institutions are both public and private. They include burgher schools with a two-year practical course, higher burgher schools with a five- and a three-year course, agricultural schools, industrial and technical schools, and a group of very special training schools. Higher burgher schools are the only ones giving broad training. They close with a state examination giving admission to higher institutions and to various kinds of state service.

Gymnasia, with courses for ages 12 to 18, and fitting for the university, are classed along with the university as higher institutions.

Training of teachers is carefully supervised and the law provides for minimum salaries of elementary teachers and for pensions in cases of disability and long service.

Belgium.— Belgium, like a number of other European nations, has had a long denominational struggle. There is an educational department under the Minister of Science and Art, who is assisted by general directors and a corps of inspectors, but in each commune there is a board possessing considerable authority, and in these denominational influence is considerable. Local independence accounts for considerable variation in the schools. Above the elementary schools, there are lower and higher secondary schools. The lower are practical schools maintained by the government and give courses of three years. Separate schools for boys and girls are established. The higher are seven-year schools (the *athénées* and a few *collèges*), and lead up to the university. Aside from these two groups, secondary schools may be established by local authorities. Higher education is provided for in four universities, two of which are state institutions, and in numerous special institutions.

Switzerland.— Because each of the 25 Swiss cantons controls its own educational affairs there results considerable lack of uniformity in the school system. Free education is provided for in the constitution. Some cantons provide free books and material. Compulsory education is common, sometimes for seven, sometimes for eight years, beginning usually at the age of 6½ or 7 years. Continuation schools are provided in all cantons. Various kinds of schools above the elementary grade exist, some giving general, others technical courses. Commercial education is stimulated by giving federal grants. The universities, of which there are seven, and the "Federal Polytechnikum" are institutions known world wide for their standards of work.

Italy.— Administrative machinery for control of Italian education is very complex. Under the Minister of Public Instruction are an undersecretary of state for public instruction and a higher council with the Minister as chairman. A vice-president of the council is appointed by the king. The council is divided into different permanent and special committees. There are also a number of special bureaus. In each province there is a special administrative head and an educational council. Some localities have a degree of independent control.

Elementary schools vary in number of grades from two to six, and may or may not be free. Under certain conditions they may receive state aid. Attendance is compulsory to the age of 12, or, in communities with the poorer schools, through the grades which are provided. Many evening and Sunday schools for illiterate adults have been established.

Secondary schools provide classical, technical, nautical and normal training in courses ranging from two to five years in length. An examination, for which a fee is charged, admits children to secondary schools at the end of the fourth elementary year. Few limits are placed upon the establishment of secondary schools, but government credit may be had only by taking the government examinations.

Universities are state institutions with separately organized administration and government. Various other higher special schools and institutes for higher training may receive contributions from state funds.

Spain.— The Spanish government seems to have taken over for inspection and support many schools, whether founded by the state itself, the provinces, towns or. religious corporations. These it controls through a general director, who, with an advisory council, is under the Minister of the Interior. A number of inspectors are employed, and in each province and town there is a school board which has considerable authority.

Attempts have been made to classify the elementary schools, but they are poorly graded, except in a few cases, and in such a state of transition that few definite statements concerning them may be made. "Institutes" admitting boys at the age of 10 and giving courses leading to the bachelor's degree, and "colleges" with shorter courses from which boys may go into the "institutes," are classed as secondary

institutions. Secondary and university education are closely related, the two being under the control of "rectors," of which there is one for each "university district." Professors in both types of institution are appointed by the king and must be university graduates. Education of girls has been for the most part in private schools or in convent schools.

Oriental Countries.— Oriental education was for centuries characteristically memoriter, imitative, nonprogressive. The two most important nations, Japan and China, have for a number of decades been making a transition to a more progressive education, largely on account of western influences.

Japan started the movement first. For about half a century she has been busy with the problem of modernizing and "westernizing" her education. At present education is controlled entirely by the state, through a Minister of Education who is a member of the Cabinet, and an educational council. Much of the regulation is by means of imperial ordinances.

Parents are compelled to send their children through a primary school, which it is the duty of the community to provide. Above the primary schools are middle schools and secondary schools of various types. The former are practical and lead toward technichal schools or toward the secondary. The secondary schools are pointed toward the university, special colleges, or other higher institutions. Some provision has been made for the education of girls in special girls' higher schools. The problem of the proper co-ordination of the various institutions is not yet completely solved. A fairly well organized system of normal schools for training elementary teachers has been developed, and also a method of certification, either on graduation from one of these schools or by examination.

China's transition has been made almost within the present century. An ancient educational system consisting for the most part of memorization of a group of Chinese classics and the passing of a series of state examinations has been overthrown. A system modeled somewhat after the western systems has been put in its place, but many of the problems are yet unsolved. Teachers educated under the old system tend to fall back into a memorization method, disregarding the teaching of the meaning of material. Governmental changes and the changes incident to rapid adaptations being made make definite statements difficult. In general it may be said that China is fast developing elementary, middle and secondary, and higher institutions to meet the needs of education throughout the nation.

Both China and Japan find difficulties arising out of the nature of their written language (a character for each word), and both meet the difficulty of finding the proper place for the classical Chinese, which bears a similar relation to their modern life that Greek and Latin do to the modern life of western nations.

Latin-American Countries.—Space permits only a general characterization of education in Latin-American countries. In all of them the development of public educational systems has been slow. The causes for this are found in their extended territory, scattered rural population, differences in the grade of culture of the several classes of inhabitants, and the tendency to patronize private institutions. Early schools were almost entirely those of the Catholic Church, and there is still a large measure of Church control. With the acquisition of independence and establishment of republican forms of government, most of these countries began building systems of public education. The majority of them have provided ministries of education, although education may be administered, in individual cases, through the Department of Interior or Department of Justice. Usually much power lies in the hands of provincial and local authorities, but in Chile there is government support of all classes of schools and the control is highly centralized under a system somewhat similar to that of France. Many of the countries have taken steps to provide free elementary education, and there have been a few partially successful attempts at compulsory attendance. Coeducation is not the rule, even in elementary schools, but exists in the lower grades of government schools in a number of cases. Elementary education is liable to be of a low standard in rural districts, but in the larger cities, and especially in the government capitals, much has been done to build up model institutions and stimulate the development of efficient schools. Normal schools have also received much governmental attention. In practically all of the leading countries some form of government secondary school may be found, supported by national, provincial or municipal funds, but much of the secondary education is carried on in private or Church schools. Secondary schools are liable to articulate poorly or not at all with the elementary schools, as is the case in some European countries. Universities are also found in most countries, although in a few cases higher training has been given by special faculties — of medicine, law, etc.— the instructors being professional men who gave part time only to teaching. The influence of the world's modern industrial development has been felt in these southern countries, and the old literary and classical tendencies have tended to give way to more practical education, as is shown by the efforts of educational ministers to introduce reforms into the school systems. Education of North American and European countries have been studied, sometimes by special commissions, and in some cases scholarships have been provided to allow young men to study abroad. See LATIN AMERICA.

United States, in Relation to Other Nations.— In both the period of their establishlishment and the later periods of development the schools of the United States have been greatly influenced by the educational situations in the various European countries. Their aims, methods and forms of organization have in a way been echoes of those in the countries whose people first settled America. The development of our Federal government, however, with its characteristic democratic spirit, has made for an educational system in which the paternalism and social distinctions characteristic of so many nations in Europe are almost entirely lacking. And so it is that the business of education is left for the most part to the several States, and is only indirectly influenced by the Federal government. The way in which all of the States have set themselves the task

of providing a co-ordinated system of elementary, secondary and higher institutions through which any child of ability may go is remarkable. Schools which parallel the "middle schools" of European countries have been slow in coming, but in recent decades have been making their appearance rapidly, as have also those similar to European "lower" or "middle technical schools." What will be their effect upon American life and society is a question full of interest and deserving careful thought. A similar and perhaps more vital problem arises from a tendency present in many quarters to push specialization down into the elementary grades.

The Present Situation.— Practically every nation's educational system is disturbed, even reorganized temporarily just at the present, as a result of the European War begun in August, 1914. Undoubtedly the outcome of that war will bring radical changes in many a nation's economic, political and social philosophy, followed by changes in both educational philosophy and educational practice. The foregoing statements are based upon conditions as they were at the beginning of the conflict and, in so far as known, as they have continued since. But habit is strong, and the probability is that any changes in national educational systems result-

COMPARATIVE STATISTICS OF PROFESSIONAL EDUCATION FOR 1900 AND 1916

Class	Schools		Students		Graduates		With A.B. or B.S.		Endowments		Reported benefactions	
	1900	1916	1900	1916	1900	1916	1900	1916	1900	1916	1900	1916
Theology	154	169	8,009	12,051	1,773	2,090	2,338	4,454	$19,979,565	$40,395,681	$1,123,802	$2,171,624
Law	96	124	12,516	22,993	3,241	4,323	2,166	4,451	567,900	2,091,592	105,500	352,027
Medicine	151	92	25,213	14,767	5,219	3,436	2,477	3,086	2,236,087	23,227,896	49,239	2,485,501
Dentistry	54	48	7,928	10,715	2,029	1,852	192	167	105,000	461,915	500	.....
Pharmacy	53	71	4,042	6,034	1,130	1,796	51	44	19,202	205,000	1,700	4,324
Veterinary medicine	13	22	362	3,064	100	759	14	47	5,064	.....	4,000	597

ing from the war will be in the nature of modifications and gradual evolutions, not sudden breaks from the old habitual courses. The general outlines here given will probably in the main hold true, therefore, for a number of years after the conclusion of the just peace for which the world waits.

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EDUCATION, Negro. See NEGRO EDUCATION.

EDUCATION, Professional. Professional education as distinguished from elementary, secondary, industrial or liberal education, is that form of higher education specially designed as a preparation for "learned," technical, commercial, or social professions or callings in which men and women deal with their fellows, with institutions, or with material things, according to abstract principles, with an understanding of natural or social forces and the ways in which they have been or may be applied. To the three "learned professions" of the older time, other professions have been added to meet the need of a developing civilization. Hence professional education takes account of dentistry, chemistry, engineering, education, pharmacy and veterinary medicine, while certain other callings are so well-organized as to their materials and methods that education for them might be included in the professional group. In this latter class belong journalism; commerce and business organization, including banking, insurance, transportation, foreign and domestic trade and accounting; public service, including expert service in federal, state, municipal, and diplomatic administration; and social service, comprising charities, corrections, Red Cross, welfare work and sociological research.

At the close of the American Revolution there were, besides the semi-ecclesiastical colleges like Harvard and Yale, only two professional schools in English-speaking America — the medical college of Philadelphia, now a part of the University of Pennsylvania, and the medical department of King's College, now Columbia University. The law school of Harvard University, the oldest of existing law schools in this country, was opened in 1817; the Baltimore College of Dental Surgery dates from 1839; the oldest school of veterinary medicine (Iowa State College) began as late as 1880. From these early beginnings the present long list of American professional schools has grown. The recent expansion of these institutions in the five clearly recognized professions, as published by the United States Bureau of Education for the years 1900 and 1916, is shown in the accompanying tabulation, from which are omitted statistics of schools which train for the professions of engineering (see TECHNICAL EDUCATION), chemistry, commerce and social service, for the reason that such training is still carried on largely in the usual four-years undergraduate course, either in close co-ordination with other undergraduate divisions or in parallel separate schools, with the inclusion of a considerable amount of fundamental or buttressing material of a non-professional character in the quasi-professional curriculum. Statistics of training schools for nurses are likewise omitted because these institutions are not, by organization, faculty, curriculum or special equipment, quite comparable with professional schools which are independent establishments, not merely adjuncts or accessories to major enterprises like hospitals which exist for an entirely different purpose.

The standards of admission, instruction and graduation in professional schools have markedly improved since 1870, notably in medicine, engineering and education. In the case of medicine the changes since 1904 have been almost revolutionary under the firm and statesmanlike guidance of the Council on Medical

Education of the American Medical Association and the Association of American Medical Colleges, two voluntary organizations within the medical profession, which have neither legal nor coercive authority over schools, licensing boards or individual teachers or students. Organizations quite similar to these two have exercised in a smaller degree an elevating influence on corresponding forms of professional education during the last two decades. Legislation by the states now regulates more or less effectively the practice, and hence the education to practice, of the last five of the six tabulated professions, and in some degree also the quasi-professions of accountancy, nursing, etc.

Several specific examples are here given to illustrate the progress just described and the present state of certain forms of professional education. The law school of Harvard College required no previous course of study in 1857; male students, 19 years of age and of good moral character, were eligible for admission. Not until 1870 was the course extended to two years; in 1877 it was raised to three years; since 1899 only graduates of approved colleges are eligible for admission. Yet in 1916 this law school had 791 students, more than any other law school in the country except certain evening schools in Chicago and in Washington, D. C. By 1916 all but 20 of the 124 law schools reporting to the Bureau of Education prescribed three-year courses and only one remained on the one-year basis; all but 26 maintained a standard year of at least 35 weeks. The requirements for admission, until after 1870, were merely a knowledge of English and the common branches; by 1880 they were made the completion of a four-years' high school course; at the present time nearly all the better schools require the completion of at least two years of work in a college of liberal arts. Though the content of the work of these two years is not prescribed, students are urged to choose such subjects as history, politics, English literature, logic, philosophy, economics and public speaking.

The professional curriculum in law is usually quite closely prescribed during at least the first year, including contracts, torts, personal property, real property, domestic relations and criminal law; for the remainder of the course a varying degree of freedom is accorded the student. The methods of instruction have been remodeled along with the changes just noted; the original lecture system was succeeded by the textbook system, and this in turn by the "case system," in which the student makes analytical studies of actual cases decided in courts, discusses these cases in the classroom, and passes examinations on them and upon lectures dealing with the principle involved. The degree of bachelor of laws (LL.B.) is generally conferred upon the completion of the regular course; certain schools, e.g., the universities of Chicago, Michigan and Yale, confer instead the degree of doctor of law (J.D. or J.U.D.) upon those graduates who entered with an A.B. or B.S. degree from an approved college. For a fourth or graduate year the degree of master of laws (M.L.) is sometimes given.

Medical education has undergone even more striking evolution than law. The early medical schools were usually connected with colleges, but, beginning in the early 19th century, came a period of about 75 years when the independent proprietary medical school flourished, to the grave detriment of the profession. In about a century 437 medical schools appeared in the United States and Canada, of which 162 were in operation in 1906 when the campaign for improvement began to prosper. The famous Flexner report on "Medical Education in the United States and Canada," published in 1910 by the Carnegie Foundation for the Advancement of Teaching, is a landmark in both medical and professional education in North America. Concerning the majority of these numerous schools the report states:

> Nothing was really essential but professors. The laboratory movement is comparatively recent. . . . Little or no investment was therefore involved. . . . Occasional dissections in time supplied a skeleton — in whole or in part — and a box of old bones. Other equipment there was practically none. The teaching was, except for a little anatomy, wholly didactic. The schools were essentially private ventures, money-making in spirit and object. . . . Many of the schools had no clinical facilities whatever. . . . The schools had two sessions of 16 to 20 weeks each; the course was ungraded and the two classes met together. The student had two chances to hear one set of lectures — and for the privilege paid two sets of fees. . . . State boards were not yet in existence. The school diploma was itself a license to practice.

From this chaotic and almost standardless condition, medical education moved up in 25 years so that the best American schools are quite the equal of the best European schools. The universities have resumed actual and vigorous control; graded courses of medical studies, adequately based on two years of college training, including chemistry, physics and zoology, and covering four school years of approximately nine months each, are the rule. Six medical schools have already taken still more advanced ground by requiring before graduation the satisfactory completion of a fifth year to be spent in an approved hospital or in other acceptable clinical work — Minnesota, Stanford, Rush, California, Northwestern and Vermont, and six State boards have established a requirement of one year's internship for licensure to practice. Numerous full-time salaried teachers have replaced the volunteer practitioner-lecturer, even in important clinical chairs. Great laboratories for instruction and research, supplemented by extensive hospitals for clinical teaching, have been built at enormous expense, sometimes by individual gifts, as in universities like Harvard, Cornell, Washington and Leland Stanford Jr., and sometimes by State or municipal appropriations, as in universities like Minnesota, Michigan, Iowa and Cincinnati, thus setting the highest standards now known in the profession. The degree of doctor of medicine (M.D.) is almost invariably conferred upon graduates. A special degree in public health (Dr.P.H. or Gr.P.H.) is given by several institutions, e.g., Michigan, Harvard and California.

Such progress meant inevitably the death of many weak and scandalous schools; by 1917 the roster of medical schools showed 96 names, of which 29 were integral parts of State universities. Proprietary, profiteering schools clearly could not live when the amount spent annually on each student in 82 schools for which an estimate was made in 1917 was $419, and the corresponding return from the student in fees was about $150, the fees ranging from $25 in Oklahoma to $275 in Columbia.

Out of 48 schools of dentistry only 12 are independent institutions. The dental curriculum covers three years of professional work based upon four years of high school, and leads to the degree of doctor of dental surgery (D.D.S.). A movement to raise the course to four years, comparable with medicine, has attained considerable momentum with the cordial support of the leaders of the profession. Tuition fees range from $60 to $200, averaging about $150.

The schools of theology represent a wide variety of standards, from the "full salvation" school (in Kentucky) to the great group of seminaries about the Catholic University of America, the Union Theological Seminary of New York, Princeton Theological Seminary, or Boston University School of Theology, all of which as a rule require a bachelor's degree or its equivalent for admission and a three-years course for graduation. The degree usually conferred is bachelor of divinity (B.D.) or bachelor of sacred theology (S.T.B.). The theological schools reporting to the bureau of education in 1900 and 1916 are summarized in the accompanying table. The attendance of 11,291 in 1916 included 760 women, but these figures do not include the considerable number of students in semi-professional Bible schools and institutes for training evangelists, missionaries and other church workers. Theological schools in 1916 were located in 32 States, New York, Pennsylvania, Ohio and Illinois having each more than 15. By denominations the distributions of 1900 and 1916 were:

	1900	1916
Roman Catholic	29	27
Presbyterian	23	20
Lutheran	22	24
Methodist	18	19
Protestant Episcopal	13	13
Congregational	11	9
Baptist	11	13
Non-sectarian	3	11
Christian and Disciples	7	9
Reformed	6	6
Universalist	3	3
Hebrew	2	2
Miscellaneous	6	13
	154	169

All but 15 of the 71 schools of pharmacy have university or college connection. Admission requirements to the two-years course are two to four years of high school; to the four-years course, usually the full high school course of four years. The former leads to the title of graduate in pharmacy (Ph.G.) or pharmaceutical chemist (Ph.C.), the latter to bachelor of science in pharmacy (B.S. in Phar.)

One of the chief reasons for the rapid development of veterinary medicine is found in the great demand by the Federal government for inspectors of food animals and by the farmers for the prevention or cure of swine and cattle diseases. Nine of the 22 veterinary schools are connected with state agricultural colleges. The course of four years is generally based on a high school education and leads to the degree of doctor of veterinary medicine (D.V.M.). The largest schools are those of Iowa, Cornell, Ohio, and Kansas City.

The training of teachers for the elementary schools does not fall under the heading of professional education, but the last decade has seen a gradual standardization of really professional training of teachers, comparable with the other professions in scope and severity of requirements. Few of the normal schools and colleges of education do more than incorporate into the regular undergraduate curriculum considerable courses in psychology, history of education, educational organization, and practice teaching in neighboring schools, or in college-controlled or laboratory schools as at the Universities of Wisconsin, Missouri and Minnesota. The better institutions limit the specialized studies in education to the last two years. Teachers College of Columbia University, which has been a graduate school since 1914, and the education divisions of graduate schools like those of Chicago, Harvard and California, are the best examples of professional courses in education, though they may not, with the exception of the first, be known technically as professional schools. The volume and significance of the researches of this group of institutions augur well for the further development of the profession.

Illustrative of the newer type of professional schools which require more than a four-years high school course for admission, are the Graduate School of Business Administration of Harvard University, the richly endowed New York School of Philanthropy, the Tuck School of Administration and Finance of Dartmouth College and the Yale School of Forestry.

So enormously expensive has the maintenance of professional education of all kinds become, that it must more and more depend upon tax-support or upon generous endowment, and less and less upon student fees and the free services of lawyers, doctors and dentists. No first class professional school can be content with mere teaching; it must engage in investigations of new conditions and new problems, in medicine, theology and education as well as in journalism, chemistry and social service, in the strenuous endeavor to master alike the social and natural forces which affect human welfare. Hence the graduate professional school and the research institution or endowment are new integral parts of professional education at the present time. Examples of these are the Graduate School of Business Administration of Harvard, medical endowments for research in cancer at Columbia and Harvard and in urology at Johns Hopkins, the Mayo Foundation for Medical Education and Research at Minnesota, the Veterinary Investigation Department of Iowa State College, the Engineering Experiment Station of the University of Illinois, and the Mellon Institute of Industrial Research and School of Specific Industries of the University of Pittsburgh.

To meet these multiplying and mounting needs of professional education, men and states have poured out during the last two decades a veritable stream of gifts and appropriations as evidence of approval of the soundness and progressiveness of the management of such schools. In 1917 the University of Chicago received nearly $5,500,000 for its medical schools. Vanderbilt, Washington, Johns Hopkins and Yale have each recently received $1,000,000 or more for medical work; Pennsylvania received more than $1,000,000 for dentistry; the Pulitzer donations to Columbia for journalism were $2,000,000. The endowments

of eight theological schools are above $1,000,000 each, three passing $2,000,000 and one (Princeton), passing $3,000,000, while the grounds, buildings and library of the General Theological Seminary of the Protestant Episcopal Church are reported at more than $2,000,000. The building and library of the law school of the University of Chicago are estimated at $500,000, and the properties of the Harvard Law School (including $600,000 of endowment) at $2,000,000.

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EDUCATION, Psychology of. In some branches of the subject, educational psychology is differentiated clearly from the general science of psychology, while in other branches the two subjects overlap. The investigation of the laws of memory, of learning, of the determinants of attention or of individual differences in endowment, has been carried on by psychologists whose interest is in the theoretical development of the science, as well as by those whose interest is in the application of psychology to education. But even in such cases, in which there is an overlapping in subject matter, the aim of the educational psychologist, which is to discover how mental growth may most effectively be promoted, usually causes him to emphasize different questions than those upon which the pure psychologist dwells. Certain branches of educational psychology, such as the psychology of learning to read, write and spell, or the construction of tests of proficiency in the school subjects, or the technique of tests of intelligence or maturity, belong wholly to this field.

The education of the child is the product of the sum of the external influences which are brought to bear upon him, and of the reactions which he makes to these influences. The study of these reactions and of their laws is the scientific foundation for rules of practice in attempting to guide and modify them. In so far as these reactions are mental their study constitutes the subject matter of educational psychology.

The differences in the child's interests and capacities as he advances from babyhood to maturity are important factors in his reactions. For the treatment of this phase of educational psychology, see the article on CHILD PSYCHOLOGY.

Principles of Learning.— In the second place the child's reactions are governed by the laws of learning,— both those which are general in their application and those which depend upon the child's stage of development. The effect of practice upon skill or excellence of performance has been studied in the case of a variety of types of learning. One of the earliest and most valuable studies was made upon the growth of ability in the telegraphic language. A number of studies have been made of the somewhat allied process of typewriting. Some light has been thrown on human learning by studies of the behavior of animals in escaping from a cage or learning to find their way through a maze. In the field of sensory discrimination and the development of perception a number of studies have been made — as, for example, in learning to discriminate between tones or colors, to overcome illusions, to apprehend and draw unusual figures. The progress in learning a foreign language has been traced. Numerous studies have been made of associative learning and memorizing. Memorizing has been investigated to discover the best mode of presentation, the best way of dividing material — e.g., into large or small parts, the effect of the learner's attitude, the permanence of memory under various conditions, etc. Finally the process of problem solving, as in the solution of puzzles, has been subjected to analysis.

One of the characteristic features of the study of learning is the construction of the practice curves, which represents graphically the rate of progress at different stages. The form of some practice curves indicates a rapid progress in the early stages, followed by a gradually decreasing rate until progress almost ceases. In other cases, however, the progress is nearly uniform while it lasts; while in a few the progress is slow at the beginning and more rapid later on. The difference may perhaps be explained by the varying ease with which old habits may be adapted to the new task.

There are various sorts of fluctuations in the curve of progress, some of short duration and some lasting over weeks or even months. A cessation in progress over a number of practice periods has been termed a plateau. Plateaus have been found to exist in several forms of learning. A number of explanations have been suggested. The earliest was that the learner develops first certain simple habits and later more complex ones, and that while he is perfecting the simpler habits as a preparation for the complex habits no apparent progress is made. Another explanation is that the learner either spurts and hence makes errors and becomes confused, or becomes lazy and fails to push ahead.

The extent to which practice or learning produces not simply special habits or ability but also general habits, attitudes, abilities or ideas which are operative in other fields than the one in which the training has taken place has been the subject of many experiments and much debate. It is now generally agreed that there is some transfer of the effects of practice, but the amount, the nature and conditions under which it occurs and the importance of transfer are matters of considerable divergence of opinion.

Among the factors which influence the rate of progress is the distribution of the practice time. In the case of the rather simple types of learning in reference to which this has been studied rather short periods of 10 to 15 minutes

have proved favorable, but it is unsafe to apply this rule very widely.

The importance of mental fatigue in hindering progress in learning or in impairing mental work has been variously estimated. A distinction must be made between true mental fatigue, as represented by an actual falling off in ability to do mental work, and the mere feeling of weariness, which may or may not indicate real reduction in ability. What has often been thought to be mental fatigue may be merely loss of interest or suggestion. But the modicum of true mental fatigue which remains when this illusory fatigue is allowed for, probably hinders learning and interferes with the more difficult mental operations.

Learning in the School Subjects.— The third branch into which education psychology may be divided deals with the processes of learning which are characteristic of the school subjects. Important studies have been made of reading which reveal the nature of the behavior of the eye and of the perception of reading matter. The eyes are shown to move along each line of print intermittently, the words being perceived during the pauses only. The pauses vary in number and duration according to the subject matter, the size of print and arrangement of the lines, and the training and individuality of the reader. It is probable that the increase in the scope of perception during a reading pause and the consequent reduction in the number of pauses is a close correlate of efficiency. The most important fact about perception in reading is that it is by word wholes or groups of words. Some attention to the letters must be given in the early stages of learning, but the letters are soon subordinated by their organization into words. A factor in this organization is the association of printed with spoken words, and even in silent reading there is a more or less distinct accompaniment of inner speech.

The writing movement has been studied chiefly by making records of the movements of the fingers, hand and arm as they contribute to the total movement as it appears at the pen point, and by measuring the speed of the pen movement and the pressure which it exerts. The fingers, hand, forearm and upper arm unite in various ways in different individuals to form a very complex and difficult movement co-ordination. Some diversity among individuals is desirable. Changes in pressure and in the speed of the stroke accompany the production of the particular letter forms. The speed changes determine the rhythm of writing, which is closely related to ease and good form.

In the field of number some work has been done, particularly with the early stages of learning. The child gets his abstract idea of number through such concrete experiences as counting, measurement and manipulating grouped objects, and there has been a good deal of discussion of the relative advantage of these experiences. Among other subjects of discussion are imagery types and their bearing on number operations, the nature of the mental process in calculation and the amount and conditions of improvement in reckoning. Little study has been made of the mental process in solving complex problems.

The problem of spelling has been attacked from several angles, to determine, for example, the relative advantages of the drill method and the incidental method of learning, the best method of presentation of spelling words, the advantage of class study in comparison with individual study, etc. Elaborate studies have also been made of adult writing vocabularies in order to discover what words should be taught.

Studies of drawing have been directed chiefly toward the development of drawing ability and interest in the child. They have shown that the young child uses drawing as a language to express his ideas with a great deal of freedom, and have led to the acceptance of much crudity in his early work, in the knowledge that greater faithfulness of representation will come later.

There has been discussion of the psychology of other subjects, such as language and literature, history, geography and science, but little experimental investigation.

Tests in the School Subjects.— Besides experiments which are designed to discover the nature of the learning process in school subjects there have been in the past few years — for the most part since 1910 — many attempts to devise standard methods or tests to make possible comparable measurement of the proficiency of children in the school subjects. These tests in some cases are made by the help of "scales" or series of specimens of pupils' products in the subject in question, graded so as to represent regularly ascending degrees of excellence, with which the products to be graded may be compared. Of this sort are several handwriting scales, a scale for judging English composition and a scale for drawing. Such scales do not by any means eliminate judgment in grading, and it is found necessary to give graders training before their scoring is uniform or comparable to the scoring of other grades; but it is possible by the use of such scales to obtain more accurate comparisons of the work of different groups of pupils than without them. The handwriting scales have proved the most successful on account of the greater ease with which excellence can be defined in handwriting than in such subjects as composition or drawing.

The other type of test consists of a series of tasks which are carefully selected so as to represent essential phases of a subject of study, and which elicit responses from the pupils which can be definitely and objectively graded. The units which enter into such a test are carefully graded by preliminary application. Sometimes they are made of as nearly equal difficulty and sometimes of progressive difficulty. The latter arrangement is desirable when pupils of a wide range of ability are to be tested. Tests of this general nature have been used chiefly in the subjects of arithmetic, reading, spelling and algebra, while beginnings have been made in some of the other subjects.

Among the questions which are being vigorously attacked by the use of tests are individual differences in the attainment of pupils in their mastery of the school subjects and the accompanying large overlapping in the ability of pupils of different ages and school grades, the large variation in the results obtained in different classes, schools or school systems, the causes of these variations and the relation of

methods of teaching or of supervision to the pupil's attainments.

General Tests.— Finally a branch of educational psychology which has been energetically pursued within the past 10 years and in which there has already been considerable development both in methodology and in outcomes, consists of tests which are designed to measure some phase of a mental function of a more general sort than is involved in one of the school subjects. Tests of sensory acuity — as of vision and hearing — and of keenness of sensory discrimination have been developed and used for a much longer puriod than 10 years. But apart from the detection of special sensory defects, for which elaborate technique and special instruments have been devised, and from the interests of theoretical psychology, the study of these elementary mental functions has in large measure given place to the attempt to measure the higher mental processes. Exception should perhaps be made of tests of pitch discrimination, which has proven significant as a means of detecting capacity for musical education, and of some other simple processes which may be important as means of determining vocational fitness. But in general the burden of opinion is that tests which involve such processes as memory, association, reflective thought and originality in meeting problems give much more valuable insight into intellectual capacity.

The recent revival of mental tests is due in large measure to the work of the French psychologist, A. Binet. Binet was given a commission to prepare a method of selecting children from the schools of Paris who were to be put into special schools for retarded pupils. In collaboration with T. Simon he arranged a series of tests graded in difficulty and designated certain points in the series as corresponding to the capacity of children at particular stages of development. In the first revision of the series in 1908 a group of tests was chosen to represent each age from 3 to 13. A still further revision in 1911 brought some rearrangement but no change in the principle of construction.

The Binet-Simon graded tests have stimulated very extensive trial of the series itself and very many attempts to standardize other single tests or groups of tests. The fundamental principle, which is that the child's advancement with age is accompanied by the attainment of the ability to perform tasks of regularly increasing difficulty and that the ability of a child to perform tasks above those which are found to be typical for his age indicates superior intelligence, while his inability to perform tasks which are typical for his age or for a lower age indicates inferior intelligence — this principle of age standards has proven to be very fruitful, although many questions of detail have arisen in the application or interpretation of the tests.

A more radical reconstruction is represented in the Yerkes-Bridges point scale which uses almost entirely Binet tests but discards the arrangement by ages. The child is given a certain number of points of credit for successfully passing each test (or partial credit for partial success) and his score is obtained by adding all his points of credit. The score is then interpreted by comparison with age, sex, etc., norms.

It is obviously of advantage to have convenient means of determining in an examination of an hour or less the degree of intelligence of the child. Imperfect as the methods thus far developed admittedly are, they are already very useful in selecting children for special education, either because they are retarded or advanced — and in examining delinquents in the courts to determine whether the delinquency is due primarily to intellectual defect.

The very extensive recent experimentation with single tests has resulted largely from the use of tests of the higher mental processes as already noticed and from the derivation and adoption of the more refined methods of calculating correlation. The significance of a test can only be determined by working out the relation between ability in the test and ability in some other test, or general ability as measured for example by the estimate of teachers or acquaintances. A test is useful according to the closeness of the correlation between attainment in the test and some other attainment representing the ability which it is designed to measure. Besides tests of general intelligence some attempt has been made, with only limited success up to the present, to devise tests of the special sorts of ability which are required in the various vocations. Tests of general intelligence themselves have proved to be of some value for vocational guidance.

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EDUCATION, Public School Organization. See PUBLIC SCHOOL ORGANIZATION; PUBLIC OR COMMON SCHOOLS.

EDUCATION, Retardation. See EDUCATION OF THE FEEBLE-MINDED AND MENTAL DEFECTIVES; RETARDATION OF PUPILS.

EDUCATION, Religious, in the United States. See RELIGIOUS EDUCATION IN THE UNITED STATES.

EDUCATION, Rural. When school systems were first organized in America, the people of this country were almost wholly engaged in agricultural pursuits. The social and civic life of the people was extremely simple. The increase in population, our great development in industrial and commercial activities, the rise

of great cities in all parts of the country, and the advancement in science and invention have been the means of establishing advanced standards of civilization which require complicated services from the social and civic institutions of the country.

Administration of Rural Schools.— The great agency in America which is to prepare our citizens for the highest possible kind of service and which is to enable them to meet successfully the great problems of a democracy, is the public school system. This enlarged scope of the function of the school has brought prominently to the attention of the public many problems which affect the economic and efficient administration of our school systems. One of the most difficult of these problems and one of paramount importance to the country at large is the proper organization and administration of rural schools. This question is, of course, one of primary importance to the agricultural sections of the country and, yet it is not exclusively related to the interests of rural communities. The number of people residing in the cities of the country has constantly increased until nearly one-half of the entire population now reside in cities. The number of the cities in the country and the population of these cities will constantly increase. There has been a decrease in the population of the agricultural sections of nearly every State in the union. The prosperous and growing cities and villages with their increasing millions of people and their great industrial plants turning out billions of dollars' worth of manufactured products to be distributed throughout the civilized world are placing additional burdens and affording greater opportunities and advantages to those who are living upon the farms.

The agricultural lands of America must supply not only the food products for the people living in the cities as well as the country and certain raw materials which are needed in the great manufacturing establishments, but they should also be able to reap the financial reward which will come from supplying the demands of foreign trade. To accomplish this result, there must be more intelligent, scientific management in our agricultural pursuits. The administration, therefore, of rural schools must have a direct and vital bearing upon the economic, industrial and commercial activities as well as upon the social and civic progress of the nation. The interdependence of the people living in the cities and of those living in the rural sections must be recognized, and the schools maintained in the rural or agricultural sections must be administered from the broad standpoint of the general needs of the nation.

There has not been the same measure of improvement in the rural schools of the country that there has been in the advancement of the schools of the cities and populous sections of the nation. The general trend of educational movements in the cities for a long period of years has been to enable the schools maintained therein to meet the living conditions and necessities of the people whom such schools serve. Unfortunately, this general object has not been in view in the administration of rural schools. There has, however, been a great change in school administration and in public sentiment in this respect within the last 15 years. Many of the leaders in national movements have come to see that the rural school problem is one of the great constructive problems in the public affairs of the country. Great energy is now being devoted to an effort to make the country schools the equal of the city schools. There has been much legislation in all parts of the country to accomplish this result. The school term has very generally been extended; compulsory education laws have been made more effective; there has been an enlarged use of school buildings and grounds with the idea of organizing the school itself as a social center; provision has been made for organizing instruction in agricultural courses in all schools; consolidation of small schools has been encouraged by the payment of larger quotas of state funds; medical inspection of school children has been authorized as a means of conserving life in agricultural communities, and provision has been made in various ways to afford boys and girls living in the remote farm sections the advantages of academic or high school training. This is a long list of important legislative measures which have been considered in many of the States. The effect of the enactment of these laws upon the efficiency of rural schools is now yielding results. However, to make the work of the rural school as efficient and as well adapted to the needs of the people as the city schools are, several important things must be done. Among these are:

1. The courses of study maintained in the rural schools must be adapted to the social and economic conditions of rural life.

2. The schools maintained in the rural sections must be in operation for a period of time equal to that which schools are maintained in the city or more populous sections.

3. The same care must be taken to conserve the life of the child in the rural community which is now generally exercised in the city.

4. The school buildings, grounds and equipment of the rural school must be as adequate and as attractive as those of the city schools.

5. The teachers employed in the rural schools must be the equal in culture, scholarship, professional training and experience of the teachers employed in the city schools.

In recent years there has been a great expansion in the courses of study intended to meet the conditions of industrial centers. The theory is that the school is not only to teach children the fundamentals of an education but it is intended to train them so that the instruction which they receive shall be of service to them when they leave school to assume their obligations of citizenship. To meet the necessities of boys and girls who go into industrial life, manual training, industrial and vocational schools have been authorized. If courses of study are to be maintained in populous centres for the purpose of meeting the needs of the industrial workers, the obligation rests upon the State to make provision for equal opportunity in the education of boys and girls who are to assume the responsibility of the future operation and management of the agricultural interests of the country. Instruction in industrial and vocational courses may be given as satisfactorily in the rural schools as in the city schools. Agriculture is the greatest industry of the nation. The schools maintained in the

agricultural regions contain the great bulk of recruits for farm life in the nation. Practical courses should be given in these schools along the lines of scientific agriculture. Potato clubs, corn clubs, canning clubs and other similar clubs related to agricultural work should be organized in every rural school. Home project work will be an important feature of a modern, efficient rural school. To illustrate: the pupils in a corn club could be shown what soil is adapted to the growing of corn and what fertilizer is essential. They could be shown how to prepare the soil for planting corn; the selection of seed could be carefully determined; the planting could be done at the proper time, and the crop could be properly cultivated; the value and necessity of frequent cultivation and of rotation in crops could be illustrated. The harvesting could be done at the proper time and under the best approved methods and the method of placing the crop in the market with the least expense and the greatest advantage to the producer could be learned. The farms located in every school district in the country should be made the great laboratories on which experimental work in farming could be carried out. The parents of children in the schools will generally be willing to co-operate with a successful teacher in the experiments which such teacher desires to make in the real live, active management of a farm. The same process could be pursued in sections where potatoes are the principal crop. Similar experiments could be made in relation to all farm products, fruit growing, etc. Matters pertaining to the management and care of the home will interest the girls; the canning of fruit, preserving vegetables, making bread, etc., are activities in which they may be interested and given instruction. In most of the great agricultural States, a State college of agriculture is maintained at public expense. These institutions are all doing great research work and are making scientific experiments and are producing information for the benefit of the farmer. This information, however, will not be of great service to the State unless there is some medium able to bring it to the general knowledge of the farmers of the State and to make of such information a practical application. Fruit exhibits and contests, vegetable exhibits and contests, similar exhibits and contests in grain and other products, the common rules to be observed in caring for poultry, and a dairy are matters which may be included in courses of study in rural schools and increase the interest in school work and make the work of the school more effective, practical and efficient. In the year 1917 800 boys pursued in the schools of New York State what is known as home project work. After paying all expenses incurred in their experiment and being assigned for their own labor $20,000, these 800 boys had a net profit of $40,000. Each of these boys earned on the average $75. Of course, some of them earned more than $75; some received less; and some sustained a loss. Is not this, however, the rule in the actual affairs of life including farming? Does not this experiment present the opportunity to show the boy who failed the causes for such failure, to point out to him how such failure may be turned to success, and to offer to him the necessary encouragement to achieve this result? These illustrations are sufficient to indicate the type of work which is to form a prominent feature of the courses of study in the future work of the rural schools of America.

It is not the custom in any of the States to maintain rural schools for the same period of time which schools are maintained in the cities. In most of the States there is a provision of law which requires the school to be maintained in every district and city of the State for a certain number of months. This period of time varies from four months to nine months. It is the custom, however, in cities to maintain school for ten months. Four weeks is usually considered a month. It is not possible to give the boy or girl in the country districts the same opportunity to obtain an education which is afforded to the boy or girl in the city unless the period of time which school is maintained in the country district is equal to the period of time that the school is maintained in the city.

Supervising and directing the health interests of children is now regarded as essential as the supervision and direction of matters pertaining to their intellectual development. This work has been organized as a part of the regular school work in nearly all the cities of the country. It should be extended to all rural schools. The conditions of children in the country districts is generally at a lower standard than the health of children in cities. The child who is compelled to attend a country school is just as much entitled to the benefits of health instructions as the child residing in the city. A child in the country district is subjected to the danger of contracting a contagious disease and is, therefore, entitled to every precaution which the State can afford to protect him from this danger. There is not the same careful supervision of the physical condition of children living in the country that there is of those living in the cities. The rural school should, therefore, be made the great agency not only in the development of health regulations, but of a knowledge of sanitary principles in all rural communities. Physical training should form a part of the curriculum of every rural school. The children in the country undoubtedly have more open air exercise than children living in the cities. This does not mean, however, that they do not need physical training which is provided for the children in the cities. The children in the country districts are generally in greater need of systematic training in physical education than the children living in the cities.

The children of the cities are afforded greater facilities for play purposes than the children of the country. It is argued that children of the country have the entire farming area in which to play and to obtain recreation. They may not obtain these privileges, however, without becoming trespassers. The children living in the country are entitled as a matter of right to playground facilities. The sites on which country schools are erected should contain a sufficient amount of land so that a playground, croquet ground and other necessary recreation and play may be organized and maintained for the benefit of the children attending such school. These facilities may be provided without large expenditure. It is entirely within the financial ability of school

districts to provide these facilities for the children. The most progressive communities are giving this subject attention. The tendency throughout the country is to erect attractive school buildings in the country districts. It costs but little more to make a country school building attractive, sanitary and to conform to the modern principles of lighting, heating and ventilating. The State school authorities of each State in the Union should possess the authority to approve the plans and specifications of every rural school building which is constructed. The grounds should also be made attractive.

There is no factor in a rural school so important as the teacher. Proper courses of study, suitable and attractive buildings with adequate equipment, the maintenance of schools for a longer period of time will not lead to the progress required in the administration of the rural schools unless teachers of better qualifications are employed in such schools. Lower standards of qualifications are now maintained for the teachers employed in rural schools than in the city and village schools. The children in attendance upon these schools will not receive the efficient instruction to which they are entitled until teachers are employed in these schools who have qualifications substantially equivalent to the qualifications provided for teachers in the populous centres. The teachers in these schools should, therefore, be required to show the completion of a four years' academic course of training and thereafter the completion of a professional course of two years which relates especially to the conditions and needs of rural life.

Consolidation of Rural Schools.— To effect the general change in the administration of rural schools to enable these institutions to accomplish the purposes which are now demanded of them, there must be a reorganization of rural school systems. Two elements are essential for the maintenance of successful rural schools. There must be a sufficient number of children to create the interest essential to the school and a sufficient amount of property to support such school without the taxation becoming burdensome. The modern idea in all parts of the country is to consolidate small rural schools into central schools so that these schools may be properly graded and advanced instruction be provided. The daily rural free delivery, the telephone, electric lights, good roads, the automobile, the auto bus and the trolley line are the advance agents of the consolidated rural school.

The first State in the Union to enact a law providing for the consolidation of school districts was New York. That State took such action as early as 1853. The action taken, however, applied to cities and villages. It did not extend to country districts. Massachusetts provided for the consolidation of schools as early as 1869 and made provision at the same time for the transportation of pupils. The consolidation act of Massachusetts related to rural schools. About 1890 Massachusetts paid less than $23,000 for the tranportation of children who lived so remote from schools that they could not walk to and from school daily. Twenty-five years later Massachusetts was paying for the same purpose $500,000. The movement for the consolidation of schools and the transportation of children has gradually extended until it has reached every State in the Union. Indiana, North Dakota, Ohio and many of the central western States have been leaders in this movement. Indiana has undoubtedly done more in the matter of consolidation of rural schools than any other State. The success of the great effort which is now being made throughout the country to improve the rural schools depends very largely upon the the consolidation of schools and the transportation of pupils. It has been established in all parts of the country that it is feasible without injustice to the taxpayer or hardship to the children to organize consolidated rural schools which will afford the country children practical, cultural and advanced courses of instruction which are the equivalent in every particular of courses which are maintained in cities and villages. It is just as feasible to maintain courses in these schools which will prepare a boy for admission to college or for industrial or professional life, as it is to maintain such courses in the cities and villages. Agricultural and industrial arts and home economic courses should form an important part of the curriculum of a school of this type, and the boys and girls desiring to pursue vocations along these lines are entitled to the same aid and encouragement that is given to the boys and girls who desire to pursue the long established traditional courses.

Transportation.— There is now an extended system of transportation of school children in operation in all parts of the country. Many agencies are now utilized extensively in taking children to and from school when these children reside too far from the school to walk to and from it daily. Boys and girls go to school portions of the year on bicycles. Various types of individual conveyances are used. The automobile has been brought into extensive use for this purpose. Automobile busses are employed in several communities. Electric lines, steam lines, motor boats, etc., are also employed. Where transportation is provided systematically and with good business regulations and supervision, the objections that have been raised are generally overcome. A child may ride from two to four miles in a comfortable wagon or other conveyance in order to attend a good school without hardship. Under proper regulation it is just as safe for children to be conveyed to school as it is for them to walk to school. Where busses or conveyances are employed for the transportation of children, they must be operated under definite regulations which are strictly observed. There should be an established route with scheduled hours for arrival and departure and drivers should carry watches and be required to meet this schedule. It is possible to arrange schedules so that children will be on the road the minimum period of time and be required to travel a minimum distance. These matters are being arranged in all parts of the country without inconvenience to the home and without interfering with the established hours which regulate farm life. No person should be employed as a driver to carry children to and from school who has not the full confidence of the community. He should be made responsible for the conduct of the children during the time they are under his care to the same extent that a teacher is re-

sponsible for their conduct while they are in school. Transportation should be provided at public expense. In many States appropriations are made to communities which provide transportation.

Highways and the Schools.— There is another modern factor which enters into the ability to provide better educational facilities in country districts and this is the improved system of highways which is being established in many of the States. Not only are the States developing improved highways, but the national government is making appropriations for the construction of highways. These roads have made rural life more attractive, have made agricultural pursuits more profitable by bringing the farm in closer touch with the markets, and they afford those living in the rural regions the opportunities of social life which prevail in the village and city. These roads have also enhanced the value of farm property. We may, therefore, confidently expect that improved State roads will be extended and developed in the future.

The greatest obstacle in the way of better rural schools is the increased cost involved in their maintenance. The relation of the country district to the city and to the State at large is such that States may with propriety and with justice to all parts of the State appropriate more money in proportion for the maintenance of rural schools than it does for the maintenance of schools in cities. The relation of the maintenance of proper rural schools to the needs of the nation itself is such that the national government has instituted a plan which contemplates national aid for rural education. The results which could be accomplished for the national service through appropriations by the national government justify the government in making such appropriations. The rural school systems of the several States should be made as practical and as efficient as the schools maintained in any of the populous centres of the country.

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EDUCATION, Secondary, in America. The history of American secondary education presents three stages of development: First, the colonial period, with its Latin grammar schools; secondly, the period extending from the Revolutionary War to the middle of the 19th century, with the "academy"; and, thirdly, the period down to the present, chiefly characterized by the growth of public high schools.

THE COLONIAL PERIOD.

1. The Founding of Grammar Schools.— The influences which most vitally affected the early development of secondary education in America were the example of the "grammar schools" of England and the rising spirit of democracy, which was largely Calvinistic in its modes of thought and kept in touch with Calvinistic portions of Europe.

Early in the history of the colony of Virginia, funds were raised and lands set apart for the endowment of a Latin grammar school. But these promising beginnings were swept away by the Indian massacre of 1622 and the school seems never to have been opened. The town of Boston set up a Latin school in 1635, which has had a continuous existence down to the present time. This school was established by vote of the citizens in a town meeting; it was supported by private donations and by the rent of certain islands in the harbor, designated by the town for that purpose; and a town rate seems to have been levied when necessary to make up a salary of $244.50 a year for the master. Other Massachusetts towns followed the example of Boston. School fees were commonly collected. A town rate, which was depended upon at first only to supplement other sources of revenue, gradually came to be the main reliance; and by the middle of the 18th century most of the grammar schools of Massachusetts charged no fee for tuition. Latin schools were early established in Connecticut; one at New Haven in 1641 and one at Hartford not later than 1642. A notable bequest of Edward Hopkins, sometime governor of Connecticut colony, available soon after the middle of the 17th century, was devoted to the maintenance of Latin grammar schools in Hartford and New Haven, and also in the towns of Hadley and Cambridge in Massachusetts. The Dutch at New Amsterdam opened a Latin school in 1659, continued for some years after the colony passed under English rule. Secondary schools were established in Pennsylvania in the latter part of the 17th century. One of these, the William Penn Charter School at Philadelphia, has continued down to the present day. King William's school at Annapolis was erected by the legislature of Maryland in 1696, and similar schools were established in different sections of the same colony. The 18th century saw schools of like character opened, partly by legislative enactment, partly by private initiative, in these and in the remaining colonies. Some of the number, like the University Grammar School in Rhode Island and the Free School at New York, were the forerunners or the accompaniments of colonial colleges.

2. Character of the Grammar Schools.— The chief emphasis in these colonial schools was laid on preparation for the college entrance examination and the requirements for admission to college determined the course of study. The colonial grammar schools accordingly taught Latin, a little Greek, religion and little else. Both grammar schools and colleges were intended especially for the directive and professional classes and had little connection with such elementary schools as there were. In Massachusetts, towns which maintained grammar schools were not required to maintain reading schools. Sometimes pupils were taught to read in grammar schools, but the grammar school teachers objected to this burden; and, too, the mixing of the two grades of instruction in one school was recognized as an evil. The grammar schools exercised a kind of selective function, discovering latent capacity for the higher studies and starting talented youth on the way to college. Those who showed capacity of a lower grade or of a different sort received little attention or encouragement.

3. The Organization of Colonial Systems.— In the organization of colonial systems of sec-

ondary education important beginnings were made. In 1647 the colonial legislature of Massachusetts decreed that an elementary school should be maintained in every town of 50 families; and that in every town of 100 families there should be a grammar school, in which students might be fitted for the university. This provision was copied by the colonies of Connecticut and New Hampshire, and in Connecticut the provision was afterward changed to require a grammar school in each county town. These New England colonies maintained and enforced such provisions down to and after the Revolution. Maryland also established by law a system of county grammar schools. When the colonies were transferred into States, after the Declaration of Independence, the systems of schools in the four colonies mentioned were continued with little change, but no other of the 13 States had anything that could be called a system of public instruction.

THE PERIOD FROM THE REVOLUTIONARY WAR TO THE CIVIL WAR.

1. The Founding of Academies.— As we approach the Revolutionary period, we find new social conditions giving rise to a new order of schools. With the growth of sectarian differences there appeared a decided tendency toward the separation of governmental from ecclesiastical affairs and thus the position of educational institutions was disturbed. This change lessened the prestige of colonial systems of education among the adherents of the religious denominations and a growing distrust of the colleges appeared among those who were most in accord with the secularizing tendency of the time. The old grammar schools were weakened by these influences and in their stead there grew up a new type of secondary school, commonly known as the academy.

Both the name and the character of the new institution were suggested by precedents in England, where the Dissenters were excluded from grammar schools and universities. In the latter part of the 17th century the non-conformist bodies first established "academies," schools in the main secondary, which, however, undertook to prepare candidates for the non-conformist ministry. The fame of these English academies seems to have influenced the thought of the American colonists in the matter of public education; first the strong theological bent of their English prototypes reappeared in the new American schools; and then the resemblance was more obvious in the wide range of studies offered, for the English academy had been more practical and technical than the university. But the American academies soon came to have a well-defined character of their own, apart from any conscious imitation of English models.

In 1726, a school for classical and theological studies was established by a Presbyterian minister at Neshaminy, in Pennsylvania. It was commonly known as the "Log College," as its home was a building made of logs. This school in the wilderness was the centre of deep and widespread interest in classical studies as well as in the religious life. It sent out large numbers of zealous pastors and teachers, who established "log colleges" all over the highlands of the middle and southern colonies. The Neshaminy Log College itself was later incorporated with what is now Princeton University. Through the efforts of Benjamin Franklin, a school was established at Philadelphia, legally incorporated as an academy in 1753, and probably the first institution in America formally designated by that title. It was under the control of a self-perpetuating board of trustees. A fund raised by private subscription for its establishment and maintenance was supplemented by a grant from the city treasury and by tuition fees, which were remitted in the case of those unable to pay. This academy organized in three departments or schools; namely, the Latin, the English and the mathematical, put little stress on the theological element and much on English language and literature and the mathematical sciences. The school ultimately developed into the University of Pennsylvania. Within two or three decades after the founding of this school at Philadelphia, a number of schools somewhat similar in character, and some of them bearing the name academy, were established in the middle and southern colonies. In New England the two Phillips academies, one at Andover in Massachusetts and the other at Exeter in New Hampshire, were incorporated in 1780 and 1781, respectively. The influence of these two schools extended to remote States, especially in the growing West; and they still rank among the strongest and most influential secondary schools. The academy movement begun in Revolutionary times grew apace even down to the period of the Civil War. More than 150 were incorporated in Massachusetts alone between 1780 and 1865. Dexter in his 'History of Education in the United States' tabulates 6,085 academies in the United States in 1850, employing 12,260 teachers and giving instruction to 263,096 pupils.

2. The Character of the Older Academies.— The old academies were generally endowed institutions, organized under the control of self-perpetuating boards of trustees or of religious bodies, established to serve the need of a wide constituency and not merely of a single community, and often located in small country places. Many of them made provision for boarders as well as for day pupils. They were not intended in any exclusive sense for the training of future members of the learned professions, although many of them developed into preparatory schools. In the Western States preparatory schools attached to colleges were commonly called "academies." But such was not the earlier purpose of the academies, which were largely schools for the middle classes and answered to a growing desire after learning for its own sake, or for the increased efficiency it would give in other than professional pursuits.

Their training was more "practical" than that of the colleges, wider and more liberal than that of the grammar schools, or of some of the colleges. They laid new stress on the study of the English language, together with grammar, rhetoric and public speaking. They taught mathematics, often including surveying and navigation; began the study of natural science, especially of natural philosophy (physics), of which astronomy constituted an important division; gave courses in geography, ancient history, English and above all American history, French often and German seldom. Latin and Greek were the substantial core of the instruction offered. In the earlier days, the

course of study was not well defined. In English, Latin and mathematics a good degree of continuity of work was apparently maintained, but in others, classes were formed at irregular periods, because of the exigencies of rural life which demanded certain courses be confined to a short winter term not interfering with farm labor. When finally definite courses of study were laid out, they varied in length from three to four or five years. Parallel courses were offered. That including classical studies and covering the required preparation for admission to some college was commonly regarded as the standard course of the school. With this might be found an English course. Afterward a scientific course was often provided.

Many of these schools were established by religious bodies. Catholic secondary schools began to appear in this period, established by the several teaching orders. The Society of Jesus founded institutions of secondary and higher education in the United States after the Revolutionary War; the Brothers of the Christian Schools opened their first school in America at Montreal in 1838; soon after set up establishments within the United States, at Baltimore and New York, and followed these elementary schools with secondary courses; and besides many conventual schools for girls were established, which drew a large clientage from other than Catholic families. The academies established by Protestant bodies usually terminated their formal connection with ecclesiastical societies upon their legal incorporation. The religious instruction which they carried on concerned itself for the most part with the broad underlying principles of Christianity, so that the non-Catholic academies, even such as had arisen from the initiative of religious societies, tended toward the non-sectarian character which has been more fully exemplified in the public schools of later times.

The grammar schools had been exclusively for boys. Such was the case with many of the academies. But others were coeducational, and there grew up also a large number of academies for girls, which were all too often weighed down with the title of "female seminary." The last two prepared the way for two types in higher education, appearing in the fourth decade of the 19th century; namely, the coeducational college and the college for women exclusively.

The academies broadened the intellectual horizon of families and communities and reinforced the protest which was arising against the narrow curriculum of the American colleges. In the absence of special schools for the training of teachers, the better elementary schools were for a long time in the hands of academy graduates. Special classes were organized in New York and Pennsylvania academies for instruction in the art of teaching and a seminary for teachers was opened in connection with Phillips Academy at Andover. When State normal schools began to be established in Massachusetts in the year 1839, suggestions for their organization and management were drawn from this seminary and from the current practice of academies. With the introduction and subsequent rapid growth of normal schools in this country a new means of secondary training of considerable importance was added, since these institutions began and continued to devote a large share of their time to work essentially academic in character and of secondary rank.

3. The Rise of the Public High School.— In the early part of the 19th century there appeared a strong demand for schools under the exclusive control of the State. The Calvinistic view of the civil power had prepared the way for State agency in education, and the steadily advancing separation between Church and State kept alive the question as to the relation of the schools to both. The well-established theory that the State should grant charters to colleges, authorizing them to manage their own affairs under close corporations, with incidental aid from the State in the shape of gifts of land or money, was long applied to secondary education as well. The first step in the establishment of public secondary schools was taken by the larger towns and municipalities, under the lead of Boston, where in 1821 was established an "English Classical School," which soon took the name of "English High School," probably imitating the style of the Edinburgh High School. The report to the school committee made at the time of its founding said: "The mode of education now adopted, and the branches of knowledge that are taught at our English grammar schools are not sufficiently extensive nor otherwise calculated to bring the powers of the mind into operation nor to qualify a youth to fill usefully and respectably many of the stations, both public and private, in which he may be placed." A three-year course was adopted, embracing English language and literature, mathematics, navigation and surveying, geography, natural philosophy (including astronomy), history, logic, and moral and political philosophy. Latin and modern languages were added afterward and the course was extended to four years. Students were received into the high school from the elementary schools of the city, but at first were not prepared for admission to college, that being the function of the Latin school. But with the addition of foreign languages to its course of study the English High School fitted its students for admission to certain higher institutions.

Other Massachusetts towns followed the lead of Boston in this matter. Philadelphia, in 1838, established the Central High School, under special authorization from the Pennsylvania legislature. Baltimore followed with the establishment of a "city college." Providence opened a public high school in 1843. Hartford, in 1847, transformed her old grammar school into a school of the newer type. New York opened a "free academy" in 1848, the name of which was afterward changed to the College of the City of New York. This school was established in accordance with a special act of the State legislature, ratified by vote of the people of the city. The growth of public high schools prior to the Civil War was not rapid. The exact number established in the first 40 years of the movement has not been accurately determined, due to the inaccuracy and meagerness of data upon the question. Inglis, compiling from data given in the report of the United States Commissioner of Education for 1904, estimates the total number established prior to 1860 at 321, indicating, however, that the esti-

mate is probably very inexact. Cubberley, following a table prepared by William T. Harris while United States Commissioner of Education, says that as late as 1860 but 69 of our present cities are regarded as having organized a clearly defined high-school course of study. Prior to the Civil War, and for a long time after it, the public high school movement encountered hostility from those who regarded the academy as the final or best solution of the problem of public secondary education. It also encountered hostility from those who were opposed on principle to the recognition of secondary education as a proper field for governmental agency.

4. The Beginnings of State Systems of Secondary Education.— Soon after the close of the Revolutionary War, new State systems of education began to be established, in which special provision was made for secondary schools. The University of the State of New York, erected in 1784, is a notable example of the strong influence which French thought then exercised in American affairs, as it realized the conception of a university put forth by Diderot and others of the great French writers of the latter half of the 18th century. It embraced the whole provision for secondary and higher education within the State, with the exception of schools of a purely private character. Its control was vested in a Board of Regents, consisting of the governor and the lieutenant-governor, ex officio, and 19 members elected by the State legislature. The reorganization of 1787 made the Board of Regents distinct from the Board of Trustees of Columbia College, with which it had been identical. This "university" exercised great influence on later systems; and in Georgia, by an act passed in 1785, "All public schools instituted, or to be supported by funds or public moneys in this State, shall be considered as parts or members of the university"; and in the territory of Michigan an act was passed in 1817 instituting a university of imposing character. The latter establishment existed mainly on paper, and the act incorporating it was repealed in 1821. The Georgia "university" also never amounted to much in its original form. But although the comprehensive type of university organization was not widely adopted, there was a general desire in the early part of the 19th century to establish complete and well-rounded systems of public instruction. The legislature of Tennessee declared in 1817 that "Institutions of learning, both academies and colleges, should ever be under the fostering care of this legislature, and in their connection with each other form a complete system of education." Even more significant is the provision of the constitution of Indiana, adopted in 1816, that "It shall be the duty of the general assembly, as soon as circumstances will permit, to provide by law for a general system of education, ascending in regular gradation from township schools to a State university wherein tuition shall be gratis and equally open to all."

For the most part, however, actual State agency in secondary education was as yet limited to the subsidizing of privately managed academies. In Massachusetts the provision for grammar schools under town control was continued after the colony became a State, but the law was so changed that only the larger towns were left subject to this requirement. At the same time academies established by private initiative were endowed by the legislature with grants of public lands. In Kentucky the State legislature granted 6,000 acres of public lands to an academy in each county. In Pennsylvania colleges and academies received financial aid from the State for many years, culminating in 1838 in a general State system of educational subsidies. Five years later such aid was discontinued. In other States the granting of State subsidies, in money or lands, to secondary and higher schools was customary for many years. For the most part there was but little system or consistency observable in the distribution of such aid; and the State-aided institutions were not subjected to any sort of State control.

It would seem an easy transition from the State policy of granting subsidies to private secondary schools to the policy of providing by law for the establishment, and even the support, of such institutions. This transition was not, however, readily made, since, as has been mentioned, many objected to the principle involved regarding secondary education as a proper field of governmental agency. The legal questions wrapped up in this latter contention were not settled until 1874, when the Supreme Court of Michigan, in what is known as the "Kalamazoo Case," decided: "Neither in our State policy, in our constitution, nor in our laws do we find the primary school districts restricted in the branches of knowledge which their officers may cause to be taught, or the grade of instruction that may be given, if their voters consent, in regular form, to bear the expense and raise the taxes for the purpose." The principle involved was applied long before this decision, however. As early as 1798 Connecticut authorized the opening of higher schools by the local authorities ("school societies"). In Massachusetts the law requiring grammar schools in the towns was so far weakened, in 1824, that towns having a population of less than 5,000 were allowed to substitute therefor an elementary school. But three years later, 1827, it was enacted that every town having 500 families should provide a master to give instruction in the history of the United States, bookkeeping, geometry, surveying and algebra; and every town having 4,000 inhabitants a master capable of giving instruction in Latin and Greek, history, rhetoric and logic. Due to the strong entrenchment of the "district system," this law was modified and even weakened many times prior to the Civil War; but in the revision of 1859 all of the essential provisions were reenacted and even bettered. Iowa adopted a provision in 1849 expressly permitting the aiding of higher grades to the public schools; and in 1858 authorized the establishment of county high schools. In New York, systematic grading of schools went steadily forward; and the "academic departments" of these schools corresponding to the high schools of other States, formed a part of the University of the State of New York and received financial aid from the literature fund. In Maryland, the county academies, which had displaced the grammar schools of colonial days, continued for many years to receive financial aid from the State. Prior to the Civil War, therefore, all later types of State interest in secondary schools of a public character were at least represented:

the "permissive" type; the obligatory type; and the type in which a complete and well-rounded system was sought.

THE PERIOD FROM THE CIVIL WAR TO THE PRESENT.

1. Statistics of Growth.— From the Civil War to 1890 data upon this point are very incomplete and inaccurate. The United States Bureau of Education, formally established in 1866, almost immediately began to collect statistics regarding secondary institutions. Difficulties were at once met in classifying such institutions and in getting reports from them. Work of secondary character was done in schools bearing all sorts of titles: academies, high schools, seminaries, female seminaries, institutes, grammar schools, preparatory schools, colleges, universities, schools of science and normal schools. It was well into the eighties before the public high schools began to rival their competitors in numbers of students. Since 1890 the growth in such schools as well as in the number of students enrolled in them has been phenomenal. The following table is compiled from the report of the United States Commissioner of Education for the year 1914:

Year	Public			Private		
	Schools	Teachers	Students	Schools	Teachers	Students
1889–90.	2,526	9,120	202,963	1,632	7,209	94,931
1894–95.	4,712	14,122	350,099	2,180	8,559	118,347
1899–1900.	6,005	20,372	519,251	1,978	10,117	110,797
1904–05	7,576	28,461	679,702	1,627	9,850	107,207
1909–10.	10,213	41,667	915,061	1,781	11,146	117,400
1913–14.	11,515	57,909	1,218,804	2,199	13,890	154,857

The tremendous growth shown has been the result of a large number of factors. In the first place, social changes of great significance have been taking place since the Civil War period. A number of these changes peculiarly important in their bearings upon secondary education need but be mentioned: the rapid increase of population containing a large percentage more or less unacquainted with our political conditions; the growth of science with resultant discoveries and inventions; and, largely in consequence of these, the multiplication of industries and vocational opportunities requiring special training. Along with these, the increase in wealth, both public and private, the growth of cities, the systematization of business and the opportunities afforded for leisure have produced far-reaching results upon secondary and higher education. In the second place, education as a study has taken a place among the sciences. In this development secondary education has received attention, especially in the field of adolescent physiology and psychology. G. Stanley Hall's notable work on 'Adolescence' (q.v.), published in 1905, started a new interest in both the kind and the extent of education which youth should receive. All of these factors are extremely complex in their bearings; and in spite of the great advances so far made, the principles of secondary education both in their administrative and theoretical aspects constitute problems rather than fixed conclusions. Some of the most important of these problems may be reviewed.

2. The Relation of Secondary to Higher Education.— While the public high school grew up primarily to serve the students who did not plan to enter college, the new institution did not long remain uninfluenced by the demands of higher institutions. In the seventies and eighties, much discussion took place relative to the wisdom of high schools emphasizing preparation for college; but the question was soon dropped and the problem of adjusting the relation between these institutions became probably the most important question in secondary education for the ensuing three or four decades.

One of the earliest methods of adjusting this relationship, and one which remains to-day as probably the most effective, is the so-called "accrediting system." This system was inaugurated by the University of Michigan in 1871. Under it the university admitted to its freshman class, without examination, such graduates of approved secondary schools as were especially recommended for that purpose by the principals of those schools. It depended upon a purely voluntary agreement between the secondary schools and the higher institutions, so that the school rather than the individual was examined; and the inquiry related chiefly to the vitality, intelligence and general effectiveness of the instruction. A large number of other State universities have adopted this general plan; some have developed elaborate and rigid means of inspecting the secondary schools, while others have failed to do so because of the large amount of work and expense involved. Some have relied to a large extent upon written reports; others have insisted upon first-hand inspection by a university officer. In 1914, according to the bulletin of the United States Bureau of Education on "Accredited Secondary Schools in the United States" (Bulletin, 1915, No. 7), at least 19 State universities relied upon lists prepared by their own authorities. A number of private universities and colleges likewise build their own lists; some examples of these are University of Chicago, Johns Hopkins University, Catholic University of America and Saint John's College.

In a considerable number of cases State laws have empowered their own State departments of education to classify and standardize secondary schools. Some erect very elaborate systems of grading and employ an adequate inspection force. In 1914 New York had an inspections division under the Board of Regents consisting of a chief and 13 assistants, of whom 10 at least gave their whole time to the work. Ohio and Minnesota are other notable examples of this system, but with a less highly developed technique than New York. In many cases, State universities accept the lists of accredited secondary schools made by the State departments; such is the practice at present in at least 10 States. In some of the Southern States the success of this system has been made possible through co-operation with the General Education Board of New York city. These State lists have served other accrediting boards throughout the country and have exerted a powerful influence toward raising standards within the States preparing them.

A third series of agencies influential in developing the accrediting system may be found

in a number of associations formed in different sections of the country and made up of representatives from both secondary schools and higher institutions. These grew up primarily to bring these representatives together for the purpose of discussing common problems; and while retaining the original purpose, they have added the work of preparing lists of accredited secondary schools for the use of the institutions represented. The parent society of this sort is the New England Association of College and Preparatory (now Secondary) Schools organized at Boston in 1885. This organization prompted the establishment of The New England College Entrance Certificate Board in 1902. This is now made up of representatives from all the leading colleges and universites of New England and has a list containing the names of more than 400 accredited secondary schools. The Association of Colleges and Preparatory Schools of the Middle States and Maryland came into existence in 1892. Out of this grew the College Entrance Examination Board in 1900. While this board relies for the most part on the examination of the individual student, its influence upon the relation between secondary and higher education is essentially the same as that of the accrediting system. The North Central Association of Colleges and Secondary Schools was formed at Evanston, Ill., in 1895; and The Association of Colleges and Preparatory Schools of the Southern States at Atlanta, Ga., in the same year. Both of these associations have extensive lists of accredited schools.

The criteria used by these different accrediting bodies differed widely in the demands they made upon secondary schools, and they still continue to do so. For example, at the present time the College Entrance Examination Board recognizes but 11 subjects as permissible in a standard high school course while the University of Minnesota recognizes 22. Some means of securing uniformity, therefore, became a significant problem; and this problem remains as vital to-day as it was in 1890. Inasmuch as no mechanical adjustment between secondary schools and colleges can settle this problem, the important attacks that have been made upon it have attempted to go to the bottom of the educational questions involved in order to get a basis for determining the details of relationship.

The first and one of the very most significant attempts at solution was made by the Committee on Secondary School Studies, appointed by the National Education Association in 1892 and known as "Committee of Ten." Nine sub-committees of 10 members each were appointed to prepare reports on the several ordinary departments of secondary school instruction; namely, Latin, Greek, English, other modern languages, mathematics, physics (with astronomy and chemistry), natural history (biology, including botany, zoölogy and physiology), history (with civil government and political economy), geography (physical geography, geology and meteorology). The Committee of Ten, having secured carefully prepared reports from its sub-committees and having examined a large number of the courses in actual use in secondary schools, drew up a report which was published by the United States government in December 1893, together with the reports of the several sub-committees. Great stress was laid on the correlation of studies in secondary schools, the unifying of many subjects into a well-knit course of instruction, through the recognition of their numerous inter-relations. The committee would have continuous instruction in the four main lines of language, mathematics, history and natural science. In particular they recommended that in the first two years of a four-year course each student should enter all of the principal fields of knowledge, in order that he may fairly "exhibit his quality and discover his tastes"; and urge the postponement of the beginning of Greek to the third year, in order that the student may not find himself at the bifurcation of the course into classical and Latin-scientific courses before he is ready, or his advisers sufficiently informed as to his capabilities, to make an intelligent choice. The committee would require in each course a maximum of 20 recitation periods a week; but they would have five of these periods devoted to unprepared work; and would reserve double periods for laboratory exercises whenever possible. With reference to requirements for admission to college, the committee recommend "that the colleges and scientific schools of the country should accept for admission to appropriate courses of their instruction the attainments of any youth who has passed creditably through a good secondary school course, no matter to what group of subjects he may have mainly devoted himself in the secondary schools." "A good secondary school course" they describe as consisting of any group of studies from those considered by the sub-committees, "provided that the sum of the studies in each of the four years amounts to 16, or 18, or 20 periods a week,—as may be thought best,—and provided, further, that in each year at least four of the subjects presented shall have been pursued at least three periods a week, and that at least three of the subjects shall have been pursued three years or more."

The next attempt at an adjustment of the relations of secondary schools and colleges, to the educational advantages of both, is contained in the report of the Committee on College Entrance Requirements, appointed in 1895 by the National Educational Association and consisting of 14 members, representing the high schools and universities of different sections of the country, under the chairmanship of the superintendent of high schools of the city of Chicago. The first important service rendered by the committee was the preparation and publication of a table showing the actual entrance requirements of 67 representative colleges, universities and higher technical schools in the United States. The committee's final report, presented at the meeting of the National Educational Association in July 1899, is mainly devoted to the attempt to establish "national units, or norms," in the several subjects taught in the secondary schools as preparatory to the college course. The fundamental problem "is to formulate courses of study in each of the several subjects of the curriculum which shall be substantially equal in value, the measure of value being both quantity and quality of work done." In the determination of these norms the committee received assistance from several bodies of expert scholars in the several branches of instruction. The supplemental papers received from these bodies are published in connection with

the committee's report. The committee adopted 14 resolutions, of which the following are of the greatest general significance:

1. That the principle of election be recognized in secondary schools.

4. That we favor a unified six-year high school course of study, beginning with the seventh grade.

6. That while the committee recognizes as suitable for recommendation by the colleges for admission the several studies enumerated in this report, and while it also recognizes the principle of large liberty to the students in secondary schools, it does not believe in unlimited election, but especially emphasizes the importance of a certain number of constants in all secondary schools and in all requirements for admission to college.

12. That we recommend that any piece of work comprehended within the studies included in this report that has covered at least one year of four periods a week in a well-equipped secondary school, under competent instruction, should be considered worthy to count toward admission to college.

In more recent times a number of attempts have been made to solve the problem of the relation between secondary and higher institutions. One of these has accomplished considerable good on the side of the mechanical aspects involved in the adjustment; namely, the National Conference Committee on Standards of Colleges and Secondary Schools, formed in 1906. This committee is composed of representatives from the accrediting associations mentioned earlier in this section, together with representatives from the National Association of State Universities, the Carnegie Foundation for the Advancement of Teaching and the United States Bureau of Education. This committee has defined the "unit" for purposes of accrediting as follows: "A unit represents a year's study in any subject in a secondary school, constituting approximately a quarter of a full year's work. This statement is designed to afford a standard of measurement for the work done in secondary schools. It takes (1) the four-year high school course as a basis, and assumes that (2) the length of the school year is from 36 to 40 weeks; that (3) a period is from 40 to 60 minutes in length; and that (4) the study is pursued four or five periods a week; but under ordinary circumstances a satisfactory year's work in any subject cannot be accomplished in less than 120 60-minute hours, or their equivalent."

The Carnegie Foundation for the Advancement of Teaching gave very serious consideration to the question of the relation of high school to college in the annual reports of 1910, 1911 and 1912. These reports make rather severe attacks upon certain practices in both the high school and the college. The former is criticized for superficial work — the covering of too many subjects with thoroughness in none. The college is criticized for insisting upon too rigid prescriptions in traditional subjects for admission; they ignore changing social conditions. The burden of solving the problem is placed primarily upon the higher institutions: they must insist upon solid four-year high school courses, but must permit a wider range in the subject-matter in them.

The National Education Association has been giving renewed attention to the problem in the past five years. In 1910 the Committee of Nine on the Articulation of High School and College was appointed. The report was presented to and adopted by the Secondary Education Department of the Association the following year. In basic principles this report is in sympathy with the position of the Carnegie Foundation. Adopting the "unit" set by the National Conference Committee on Standards of Colleges and Secondary Schools, it recommends the following standard high school course: Nine specified units; three of English, two of one foreign language, two of mathematics, one of social science, including history, and one of natural science; two additional academic units, and four units left as a margin for whatever work best meets the need of the individual. A much more radical and fundamental solution of the question has been under consideration for the past four years by a committee of the National Education Association known as the Committee on Economy of Time in Education. A report of this committee was published by the United States Bureau of Education in 1913 and remains essentially unchanged as it is being discussed to-day. So far as the question here at issue is concerned, the following of its recommendations are most significant: The elementary school should take the child from 6 to 12; the high school period should be from 12 to 18 or 12 to 16, and the college period from 18 to 20 or 16 to 20. "The proposition," says the report, "to make the high school period 12–18 or 12–16 and the college period 18–20 or 16–20 will adjust itself in the following ways: (1) It begins high school work at the proper time and continues it to the recognized age of college admission or of beginning life (12–18); (2) it provides for a large number who will enter vocations at 16 and adjusts itself to the idea of an intermediate industrial school (12–16); (3) it provides for the contingency that the college course in the reorganized scheme will end with the sophomore year and that the two years of college may be done in the university or in the larger high schools, and that the independent colleges may make a four-year course (16–20), admitting from the smaller high schools at 16."

3. Relation of the High School Course to Social Conditions and to the Needs of the Student.—In spite of the so-called "domination" of the college over the high school, the latter institution has at no time in its history suppressed its original ideal of serving the youth of all classes. The lack of an energetic response on the part of the high school to changing social demands has been due in part to a basic principle of social psychology; namely, custom. The Renaissance ideal of a liberal education was the ideal of secondary education everywhere. It was well into the last half of the 19th century before the modern social view of education affected practice to any significant extent. Certain important changes in the course of study responding to this view have been made; many others are in the process of adoption.

One of the earlier movements of this character was the manual training movement, inaugurated by the foreign exhibits at the Phila-

delphia Centennial Exposition in 1876. The first manual training high school established in the United States was that opened in 1880 in connection with Washington University at Saint Louis. In 1884 the Commercial Club of Chicago established the first private independent manual training high school in the country; the first public high school of this character was opened the same year at Baltimore. By 1890 at least 38 cities had such high schools; and by 1905 at least 63 cities had followed the example. Besides these, many academic courses had included the subject. In these schools and courses the idea of manual training for the purpose of general culture was usually uppermost, their projectors disclaiming any intention of establishing schools for the teaching of trades. At present there is a tendency to view the subject from the social and practical standpoint rather than from the disciplinary.

The commercial branches had their first appearance in secondary school courses very early in the form of bookkeeping and commercial arithmetic. In the second quarter of the last century, private business schools began to flourish; and during the period from 1850 to 1890 they multiplied rapidly and furnished practically all of the training demanded for purely clerical positions. The first Commercial High School, now in existence, was established by the city of Pittsburgh in 1872; the next was the Business High School of Washington, D. C., established in 1890; Los Angeles, Cal., came third in 1895. Other large cities followed: Louisville, Ky.; San Francisco, Cal.; Philadelphia, Pa.; Syracuse, Brooklyn and New York City. Commercial courses were multiplied in academic high schools, and private business colleges waned in popularity for a time. In 1914 the United States Bureau of Education reported 2,914 public and private high schools offering commercial courses to 178,707 students. Very recently criticism has begun to the effect that commercial courses in public high schools do not after all really fit students for business; they approach their work from a point of view too academic. Some of the better commercial high schools are attempting to overcome this weakness by articulating the courses directly with commercial life; Boston and Cleveland furnish good examples of this tendency.

Preparation for agricultural pursuits through the high school began about 20 years ago, when Alabama established a school of this character in each of the nine congressional districts of the State. Five years later Wisconsin instituted its system of county schools of agriculture and domestic economy. This movement has gone steadily forward, and there are now at least 1,677 high schools, either public or private, giving courses in agriculture to 34,367 students.

At present there is no more important problem facing secondary school administration than that relative to the extension of vocational work in the high schools. States, cities and even the National government are taking an active interest in the question. Some States are encouraging the establishment of such courses by means of appropriations; many of the larger cities have already established them and are making elaborate vocational surveys looking toward their extension; and the question of Federal support to the movement in smaller places is being discussed. This whole movement centers for the most part in the secondary school period; and in this country the fixing of this period between the ages of 14 and 18 and the almost universal provision for it of a type of education essentially liberal in character cause the movement to be attended with tremendous difficulties which bid fair to produce far-reaching and fundamental reorganization within the whole secondary system. Significant steps in this reorganization have already been ventured. One of these may be found in the newer type of technical or vocational high schools. In these the older kinds of manual training work have been given a distinctly new turn toward the practical; trade courses of a high order have been added; and the academic subjects retained have in large part been treated from the standpoint of their bearing upon the practical work. Notable examples are the Albert G. Lane Technical High School of Chicago, opened in 1908; the Technical High School of Cleveland, opened in the same year; the Technical High School of Newton, Mass., opened in 1909, and the High School of Practical Arts for Girls, opened in Boston in 1907. A second type of readjustment, which has received at least a trial, is the so-called "Part-Time Cooperative Plan," well illustrated in the High School at Fitchburg, Mass. In 1908 a number of manufacturers together with the school authorities agreed upon the establishment of a combined shop and school course four years in length. During the first year the student spends his whole time in the school; for the next three years, he alternates weekly between shop and school, getting pay for the time he spends in the former. By this method the student gets actual shop training under shop conditions and secures a type of school work bearing directly upon the problems to be faced later in the calling. The Continuation School, so prominent in Germany, seems to offer a third type of desirable reorganization suitable to the needs of this country. Under this plan the employers permit their employees to attend vocational courses from four to six hours a week without loss of pay. Cincinnati began a high school course of this character in 1909. A fourth form of readjustment seems destined to give prominence to a kind of secondary school which is at total variance with the traditional ideals; namely, the Trade School. Such schools take boys and girls 16 years of age or over and, with little regard to their previous training, aim to provide them with skill in a particular trade. Examples are the Manhattan Trade School for Girls in New York City; the Philadelphia Trades School; the Milwaukee Trade School for Boys and a like one for girls, and the Worcester Trade School in Massachusetts.

Another form of adjusting the relation between secondary education and vocational life is so significant that it deserves special mention. For a long time it has been a question among educators whether our secondary school period did not begin too late; evidences of this feeling have been mentioned in connection with the discussion relative to the articulation of high school and college, notably the report of the Committee on Economy of Time in Education. In more recent times, studies in retardation and elimination have brought the question distinctly to the foreground. If boys and girls who need it most are to get any school training at all

which is directly correlated with the demands later to be made upon them, they must begin before the close of the elementary school period as it now exists. To meet this situation, what is known as "prevocational work" has been established in the seventh and eighth grades. In some schools a ninth grade has been instituted and shares in this kind of work. At present there is a strong movement toward giving these grades, in whole or in part, a distinctive organization and name. So far as the titles are concerned, two are struggling for distinction, "The Intermediate School" and the "Junior High School." According to Briggs's treatment of the movement in the report of the United States Commissioner of Education for 1914, at least 193 cities have effected an organization of the upper grades in some ways corresponding to the ideas contemplated in the movement. By many it is hoped that the next step in the movement will be the general adoption of a junior high school, taking the student from 12 to 15, to be followed by a senior high school carrying the work on to the 18th year. By this organization the differentiated courses of the one school would be directly articulated with those of the other. Just what this differentiation shall be is now under discussion; four types of courses are already prominent: the academic, the commercial, the household arts for girls and the industrial arts for boys.

Numerous as the difficulties of mechanical adjustment are in this whole movement for vocational training, they by no means exhaust the problems. The internal make-up of the courses is hard to effect, due to the lack of texts and to the lack of first-hand knowledge regarding the demands of the numerous callings; teachers who combine teaching ability with wide vocational experience are rare; and the relative amounts of attention to give to theory and to practice are very difficult to determine. Experience in the field has led to an increasing number of new needs and possibilities. The Vocational Guidance movement may be cited as one of the most significant. For the student to decide upon a calling he needs to have a rather wide knowledge about the demands of numerous vocations as well as a knowledge of his own capabilities and tastes. His location in a proper position, too, requires caution and direction. The course of study must provide for the first and a capable director is needed for guidance in the latter two. A few cities have made great advance already in attacking the question; the best known of these are Boston, Mass., and Grand Rapids, Mich. The vocation bureau of the former city was established in 1908 by Mrs. Quincy A. Shaw under plans worked out by the late Dr. Frank Parsons. Meyer Bloomfield, the present director, has extended the work greatly and has described the results and problems in his 'Youth, School and Vocation.' The developments in Grand Rapids have been largely due to the work of the principal of the high school, Jesse B. Davis, whose book on 'Vocational and Moral Guidance' is exceptionally strong on the side of the educational aspects of the question.

The traditional secondary school course has not remained uninfluenced by the social and vocational movements in education; the course of study is receiving severe attacks from many quarters. The older problem of articulating high school and college is being supplanted by the problem of adjusting courses of study to the needs of individual students and to social and civic life. The conception of liberal education is undergoing change; and in partial response to it, the "general course" is appearing among the parallel groups. Certain new studies have begun to appear, likewise, such as "general science," "community civics," art, history of art and music appreciation. Two very significant criticisms of the high school course have been issued recently by the General Education Board of New York city: one prepared by Charles W. Eliot, entitled 'Changes Needed in American Secondary Education,' and the other by Abraham Flexner, entitled 'A Modern School.'. The former would, aside from the introduction of vocational subjects, have more emphasis placed upon sense training through the sciences and drawing and more time for music. The latter article would have four fields represented in the curriculum — science, industry, æsthetics and civics; and within some of the subjects, radical reforms are contemplated in the way of bringing them into more direct bearing upon cultural and social life. Such reforms are proposed in particular for mathematics, ancient history and the modern languages; grammar, Latin and Greek would be eliminated entirely.

4. Problems in Method and Management.— The great changes in the aim and course of study have been accompanied by changes equally significant in method and management. The laboratory method which came with the introduction of the sciences, needs but mere mention. Means for vitalizing these subjects, as well as of others, have multiplied greatly: pictures, charts, diagrams, museums, models, and moving picture appliances are examples. For the past 10 years New York State has appropriated annually $20,000 for visual aids to instruction. The numerous criticisms of the results obtained in modern language instruction have led to the partial adoption of the "Direct Method" in these branches. Dissatisfaction with results in English have led to an interest in the "Co-operation Plan," whereby all of the teachers in a given school submit part of their written work to the English teachers. Analytic and drill methods in history and literature are felt to be overdone and the so-called "Appreciation Lesson" is receiving a place in the newer books on high school method. Wider reading, fewer technical questions, dramatic presentation and more flexibility in general are required in this type of recitation. The learner, finally, is coming to be looked upon as a more important item in discussions of method than the teacher, and "teaching the pupil how to study" has come to be one of the newer efforts in the high school. A part of this involves library instruction or how to use books. All of these advances in method are virtually attempts to avoid a part of the cramming procedure which grew up while college entrance was looked upon as the chief purpose of the high school.

Changes quite as important are taking place in the field of management. The rapid growth of high schools has resulted in the bringing together of a large number of students in a single school; and athletic associations, dramatic societies, debating teams, fraternities, and all kinds of clubs have grown up. Both the social

and educational philosophy of the past two or three decades have pointed to the "Self-government" scheme as the wisest solution of most of the questions of control involved. In New York city, a "General Organization" has been effected to which a large number of the high schools of the city have subscribed. Each student in a given school, upon payment of twenty-five cents, becomes a member of this organization as effected in his own school. Such student members then adopt a constitution and a set of by-laws which govern all the societies and clubs of the school. In some high schools, school savings banks are instituted and placed under the management of students. Co-operation with the home, with the authorities of the local government, and with other associations or societies in the community may be cited as added evidences of the ideal to bring the high school into close connection with all the better forces in society.

5. The Preparation of Secondary School Teachers.— A committee of the National Education Association — the so-called Committee of Fifteen on elementary education — reported in 1895, among other topics, on the training of teachers for secondary schools. The committee declared that, "The degree of scholarship required for secondary teachers is by common consent fixed at a collegiate education." They proposed a course of special training for such teachers, consisting of instruction during the senior year of the college course in psychology, methodology, school systems and the history, philosophy and art of education; and a graduate year of practice in teaching, under close supervision, supplemented by advanced studies in educational theory. That this proposal is far in advance of common practice or requirement no one acquainted with general conditions can doubt. To just what extent States and cities are tending in the direction of this early proposal — which still remains the ideal — can be determined only through a study of the widely varying and detailed laws and regulations now in force. Some of the larger cities closely approximate these ideals with the exception of the graduate study requirements; and the latter are often rewarded though not required. The very general "experience" requirement in large cities makes practice teaching unnecessary. One State — California — has very nearly met all of the requirements set forth in the proposals of 1895; a college degree from a recognized institution, graduate study both academic and professional amounting to one year or its equivalent, and practice teaching in the absence of experience are demanded. The State Board of Education is empowered by law to fix the details of certification regulations. In a considerable number of States, professional study of an undergraduate character is required of applicants qualifying under certain conditions. In general, the teaching force in the smaller high schools is not specifically prepared for the work it has to do. In New York State in 1914 very nearly one-half of all the high school teachers in the towns (as opposed to the cities) were holding normal school diploma licenses. In most sections of the country a strong tendency exists to employ only college graduates for high school teachers; but definite and serious study in the pedagogy of secondary training appears very rarely as a requirement either through custom or law. What pedagogy that is required is usually of the general kind. About 50 per cent of the high school teachers of Vermont in 1914 had not even had this. The State Commissioner of Education for Massachusetts in the report of 1912–13 complains that while most of the high school teachers of the state are college graduates and that while many have taken pedagogical courses in such institutions, they "are, in relation to the work they are expected to do, deficient in professional training" and "approach their work as learners, as apprentices, to whom practical means and methods of effectively teaching boys and girls are as yet almost wholly unknown." Definitely planned systems for the training of secondary teachers do not exist in this country. Aside from the State College for Teachers at Albany, N. Y., which makes the preparation of high school teachers its main purpose, and several specific courses in other normal schools of the country looking in the same direction, the only means generally prevalent is that of the college and university departments of education, of which there are now some 350 of recognized standing. These, however, emphasize for the most part the general courses in education; secondary method in some of the branches taught in the high school receive attention, but usually from the professors in these subjects in the college; and few have well-organized practice teaching. Other means in the improvement of secondary teachers are summer school courses, reading circles, teachers' associations, teachers' meetings within a given school, travel bureaus, sabbatical years, and the like; but these must be considered only a very small part of the solution to the larger problem to be faced in the systematic professional training of instructors for high schools.

6. Tendencies in the Organization of State Systems of Secondary Education.— Nothing closely approximating the highly centralized system of French and German secondary education exists in this country. While the State is the legal unit of educational administration in this country, powers with reference to detail in organization are usually delegated to State boards of education, cities, counties, or even smaller units. The real test of the centralizing tendency in this country, therefore, resides in the extent to which the State, either by law directly or indirectly by delegation to the State Board of Education, takes a hand in the vital detail of organization in schools. The application of this test to current practice shows results of a widely varying character so far as secondary education is concerned. A large number of the States provide for inspection of schools of this kind through an officer usually called "high school inspector"; in a few States deputy commissioners of education are appointed and assigned to secondary schools; in some cases, inspection is little more than a formality, while in others it is very careful and results in approved lists of schools that are accepted by the State universities; some half-dozen States employ systems of classifying high schools into grades and set minimal course requirements for each; in very few instances are actual courses of study directly controlled by State boards. The laws relative to the establishment of high schools are in most of the States "permissive" in character; and while

State aid is quite general for schools in rural districts, it is usually small in amount and cautiously guarded. Complete State certification of secondary teachers seldom exists. Large cities constitute a class by themselves, and central control is almost unknown to them. Neither uniformity nor the centralized systems of Europe would necessarily mean efficiency in America. What is most needed are State boards of education, free from political influence, composed of men with large views and expert knowledge, and devoting themselves to vital questions of policy and vital questions of organization too large for the local administrative units.

A number of States began early to take certain steps toward efficient control, and recent times have added to the number; three or four among these may be mentioned. Massachusetts has already been discussed; the compulsory establishment of high schools, State aid to the poorer districts, and minimum course requirements of earlier years have persisted; and new extensions have been made in the way of State certification of teachers in the State-aided schools, State support for vocational education and inspection. Minnesota began a State system in 1881, headed by a State high school board which still exists and exercises such powers as approving courses of study, inspecting all high schools once a year, and determining what institutions shall receive aid. California and New Jersey have made notable advances in methods of certifying teachers and prescribing requirements for the same. New York, however, represents the most complete State system of control yet developed in this country. This system has been described in part already. Under it, all incorporated secondary schools are controlled by a Board of Regents serving as members of the University of the State of New York. This board manages the State funds to be distributed to secondary schools. Such funds, amounting to nearly $60,000 as early as 1832, have been added to by the legislature until in 1913 the total sum contributed to secondary schools was $650,000. Approximately $140,000 of this was given for books and apparatus and $322,398 for the payment of non-resident tuition, the remainder being apportioned on the basis of attendance of academic pupils. The Board also prescribes rules for awarding the State scholarships of $100 each to graduates of high schools to aid them in pursuing college work. Ultimately there will be 3,000 of such scholarships; in 1914 awards were made to 750 secondary school graduates. A large force of inspectors, assigned mostly according to branches of study, exercises supervision of instruction; and an assistant commissioner of secondary education devotes his whole time to this branch of education. For the purpose of instituting a uniform basis for the apportionment of the so-called "literature fund," the Regents adopted in 1864 a system of examinations of elementary pupils. In 1878, this system was extended to the academic branches; and in 1913, such examinations were held in 889 schools, with 404,576 papers written, of which 288,194 were accepted. These papers were first graded at the schools and then regraded under direction of the Regents at Albany. A special examination board under control of the Regents now prepares the questions. Each school falling under control of this central Board of Regents must report yearly to it and gets a rating in the annual report. By these four means — apportionment, examinations, inspection and reports — the Board of Regents exercises most of its far-reaching control over the secondary schools of the State.

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EDUCATION, Secretarial. See SECRETARIAL EDUCATION.

EDUCATION, The State Universities. See STATE UNIVERSITIES.

EDUCATION, Study of. The study of education is, on the one hand, the study of a profession — the profession of the teacher, of whatever grade; and, on the other, the study of a social force — the force that preserves and improves the civilization of each generation, and transmits it to the next — and of the institutions which society has developed for the organization and administration of this force. It goes without saying that these two aspects of the Study of Education are not independent of each other. Further, it is clear that the study is either a professional or a "liberal" study in accordance with the object with which it is pursued. In this article no pains will be taken to keep these two aspects of the subject distinct. The context will make clear which aspect is under consideration, and also when both aspects are considered together.

The systematic study of education is now carried on in the United States chiefly in normal schools (State, city or private) and in colleges and universities. Less extended but often valuable opportunities for the study of education are afforded by county training schools for teachers, by classes in some high schools and academies, and by some other institutions: as, for example, training schools for kindergartners; some departments of the so-called "Institutes" (like Drexel Institute of Philadelphia, Pratt Institute of Brooklyn); and by "Teachers' Institutes." Teachers' institutes are carried on in towns or counties, for a few days or weeks, usually during the long summer vacation, and commonly receive support from the State treasury; they have been described as normal schools with very short courses of study. This article deals only with the study of education in normal schools, and in colleges and universities; because the work done by them is typical, and sufficiently comprehensive to cover the special work done in the other institutions mentioned. It may be said, however, that in general, the normal school aims only at the professional study of education; that the college or university department of education aims at both a professional and a "liberal" study of the subject, but of a higher grade than that of the normal school; and that the university "School of Education" aims at a professional study of education only, but, at present, of the grades undertaken by both the normal schools and the university departments of education. University schools of education are of recent origin, but they are already numerous.

Normal Schools.— The systematic study of education in this country has a rather brief history. Although some beginnings had been made in the academies of New York and New England, the study of education really began in the State normal schools for the training of elementary school teachers, of which the first was founded in Lexington, Mass., in 1839. It began there with the study of methods of teaching the common branches of the elementary school curriculum, and the methods of governing or managing a class or a school. That is to say, the study of education began with the study of methods. For a long time the study of methods comprised the whole of the study of education, although it did not cover the whole work of the normal schools. Most of these schools gave, from the very beginning, and many of them still give, more attention to the study of the branches that the prospective teachers are to teach, and to extending the range of their scholarship beyond those branches, than they gave and give to the study of methods. At the same time they naturally emphasized the study of methods from the beginning, and they still do so. This was natural, and, within reasonable limits, desirable. It happened, however, that many normal schools pursued the study of methods with such exaggeration of emphasis and such minuteness of detail that they are chiefly responsible for the development of an erroneous conception — namely, that the study of education is still practically identical with the study of methods; and this conception has done much to discredit the proper study of education and to prevent its appropriate development. How narrow and inadequate this conception is has already been suggested. It is not strange that the normal schools should emphasize the study of methods. Their function is to train teachers; and to teach well and govern wisely is the first duty of the teacher. But a good teacher not merely possesses a good method; he uses that method with discriminating insight into its efficacy, and with careful adaptation to the needs of every pupil. He not only commands the technique of his art, but he understands the principles on which his art is based, and has a clear conception of the ends which his methods are to serve. Moreover, the study of methods was, too often, merely the study of a particular way of doing a particular thing — how to teach reading, spelling, writing, arithmetic and so on; or how to secure conformity to this, that or the other rule of conduct; and this was (and is still) too often done in such a way as to convey the impression to the neophyte that there is no other correct way. The tendency of such instruction is, of course, to mechanize and not to vitalize instruction. In the hands of the less capable the study of education becomes under such circumstances the inculcation of a mere routine; individual initiative and self-criticism are suppressed or discouraged. In the hands of the more capable the result is not so bad; but even in their hands the study of methods is elevated into an importance that enables it to obscure other fundamental aspects of the study of education and of the right training of teachers. Instruction in methods did, however, develop systematic teaching where before there had been loose or haphazard procedure. By and large, the teachers trained in the normal schools proved their superiority over their untrained predecessors and contemporaries. The normal school study of education, in spite of its narrowness, did bear good fruit. But the results were still unsatisfactory. The means and methods of education were studied, but the tendency to use them blindly and mechanically was too obvious to be overlooked. The study of education, thus far, had not penetrated to the root of the matter.

The conventional scheme of education as expressed in existing programs ("courses") of study, and equally conventional methods of teaching and discipline, had been accepted without critical analysis of what it was all for, and to what extent the means and methods employed were adapted to the nature of the children to be taught and to the demands of modern life. Accordingly, it began to be clear that the study of education must mean more than the study of methods — the devices of teaching and governing. It was perceived that the mere acquisition of these devices often failed to impart life and purpose to the teacher's work. Gradually it was perceived that what was lacking in the study of education was the assimilation of guiding principles which should forever prevent the teacher from conceiving his work as a mere routine, but should enable him to conceive it throughout as a rationalized endeavor. It was natural that these guiding principles should be sought, first of all, in psychology, which, as the science of mind, should reveal the process of learning; and by implication should therefore give an insight into the process of teaching. "As we learn, so must we teach." Moreover, the Prussian normal schools, which had served as models for our own, had long incorporated the study of psychology into their programs of study, and this feature of their programs, which, to be sure, had also found its way into our own but had been without special significance, was now seized upon as the chief source of the guiding principles we were seeking. This was about 1885. Before that time psychology or "mental philosophy" had been pursued in our normal schools as an independent study without vital relation to the study of education. Now, however, this relation was perceived, and an extraordinary devotion to psychology as the key to all educational problems was the result. Before long, also, certain phases of psychology or particular psychological theories, notably the Herbartain theory of "apperception" and the derived theories of the "concentration" or "correlation" of studies, were heralded as the very gospel of educational salvation. There is truth in the theory of apperception and of the correlation of studies; but these theories were pursued and applied for a time with such extravagant and misguided enthusiasm, particularly in the Middle West, that they became "fads"; and many sins were committed in their names by large numbers of well-meaning but not well-informed teachers and other students of education. Naturally, also, educational charlatans saw their opportunity in this conspicuous popularity of psychology, and were not slow to grasp a profit from it by the sale of their wares in the form of lectures and books; and much useless or misleading talk and trivial and unscientific psychological literature was abroad in the land.

The most extravagant development of the

study of psychology by students of education was "child study" which swept the country over from border to border some years ago. Parents, teachers or other students of education were discredited unless they endeavored themselves to make some contribution to the psychology of childhood, and these contributions were actually attempted by teachers of all grades and by other persons of all degrees of intelligence. This excitement was, however, short-lived — it lasted 10 years at most. This was because a large part of the data which had been so enthusiastically collected, together with most of the "scientific" conclusions to which it was alleged they pointed, were held in slight esteem by the real psychologists. Such a result was inevitable. The psychology of childhood can be developed as a science only by persons trained for that purpose, just as physical science can be developed only by trained scientists. It was then seen that the chief advantage to be derived from the study of children by untrained observers was the effect on the observers themselves. Not to extend the boundaries of the science of psychology, but to interest the observers in children, to enable them to get into relation with child-life — that is the real value of child-study for most persons. And wherever this conception of its value prevails the study of children is to-day rendering good service to students of education. The acute stage of extravagant devotion to psychology as a part of the study of education is now happily past; and only good can be expected of the saner pursuit of it, which is fast becoming the rule.

From the foregoing it is already clear that far more was expected of psychology than could be realized. But more needs to be said on this point. Psychology is even yet in its formative stage as a natural science, and 30 years ago was just emerging from its thralldom to metaphysics. It was, however, assumed to be a perfected science — a complete and accurate account of mental phenomena and their interdependence; and hence the extravagant expectations entertained of its value in giving insight into educational problems and a command over teaching processes. These expectations could not be realized; for, as has just been said, psychology is still a formative science and cannot therefore guarantee the complete insight into mental life — especially the mental life of children, which it was believed to yield; and even if it were to-day all that it was then thought to be — a perfected science of mental life, and particularly of mental development — the acquisition of that science would not necessarily ensure technical skill on the part of the teacher. Insight and the practical application of insight are two very different things. Nevertheless, the widespread devotion to the study of psychology in normal schools and by teachers was a great gain to the study of education. It established the fact once for all that methods of teaching and governing have a rational basis in the constitution of human nature, and that it is the duty of the student of education and the teacher to ascertain what this basis is as nearly as he can. The study of education in normal schools had now progressed beyond the study of methods as mere devices to a study of these devices as based on the nature of the minds subjected to them. That is to say, the study of education had gradually come to include "educational psychology," and in particular the psychology of childhood and adolescence.

Meanwhile, again following the lead of the Prussian normal schools, light for the path of the student of education was also sought in the records of the past. The history of education was appealed to for guidance in solving contemporary problems of teaching and governing. It was only natural that a narrow conception of the significance of the history of education should have been entertained, because the study of education itself was still quite generally interpreted as the study of methods. Naturally, therefore, educational biography and "educational classics" or monographs setting forth the educational theories of individuals of the past — both usually without reference to their social setting in the general history of their time — constituted nearly all that was studied as the history of education. In spite of this narrow interpretation of the history of education the study of that subject, like the study of psychology, was a great gain to the study of education. The recognition of the kinship of contemporary education with that of the past necessarily broadened and dignified the conception generally entertained of the meaning of education itself and naturally enhanced the value of the study of that subject. For, although the history of education was at first inadequately conceived and taught, it was inevitable that it should ere long be recognized at its true value, namely, as a part of general history; and hence that the student of education should come to realize that in studying the history of education he was studying nothing less than the history of culture — of the training of each generation to assume its share in preserving, improving and transmitting to the oncoming generation the resources of our civilization, and in so doing actively to promote the progressive solution of its problems. This true conception of the history of education is, however, of very recent development. Although some of the normal schools have contributed to its development, many of them still adhere to the older conception, and it has remained for colleges and universities to give form and substance to the new conception and to disseminate it.

Meanwhile, also, the study of education was gradually extended to include an examination into the adequacy and effectiveness of contemporary schools and studies as a means of promoting the normal development of each individual as an individual and also as a means of adapting him to the civilization of his time — the twofold aim of all general education; and this questioning, together with the formulation of the more or less satisfactory replies to it, sometimes alone but more commonly closely associated with educational psychology, constitute what is now often called "Science of Education," "Philosophy of Education," or more appropriately "Educational Theory" or "General Principles of Education." In the light of the foregoing description of the historical development of the study of education in normal schools the present scope and aims of that study in those schools may be briefly summarized as follows:

It includes (1) Theory of Education or General Principles of Education, sometimes called "Science of Education" or "Philosophy of Education," pursued as a means of awakening interest in and developing insight into the general problems of education (often not distinct nor separable from (4) below); (2) Methods; (3) Kindergarten Theory and Practice; (4) Psychology and the Study of Children, pursued as a source of information about the development of mental life and the processes of learning and as a rational basis for methods of teaching and discipline — that is, psychology pursued as a science on which the art of teaching and managing children might be based and the study of children pursued chiefly as a means of developing a comprehending and sympathetic attitude toward children on the part of future teachers; (5) The Study of Teaching by observation and practice in "model schools" or "training schools"; (6) School Organization and Management, chiefly internal organization and class management; (7) The History of Education, usually pursued as a source of suggestions for planning contemporary studies and methods of teaching and management and, to a limited extent also, as a means of developing a broader professional outlook over and better professional insight into educational problems as problems of social evolution; (8) School Hygiene; (9) School Laws as a source of practical information concerning the teachers' legal rights, privileges and duties.

As was pointed out above the work of normal schools is not confined to the study of education; but so far as that study itself is concerned the foregoing enumeration covers the ground, although not all of it is necessarily found in all normal schools. The foregoing description also reveals the aim of the study of education in normal schools. That aim is primarily the technical preparation of the classroom teacher. Finally, it should be said that many normal schools are far inferior to others in the adequacy with which they conceive the study of education and in the thoroughness with which that study is carried on.

Colleges and Universities.— Great as the services are which the normal schools rendered it gradually became clear that they were alone unable to cope with the rapidly growing need of a more comprehensive as well as a more intensive study of education than they could supply. Some time before the end of the 19th century the normal schools had made clear the great distinction between a trained and an untrained teacher, as was pointed out above; and they had, accordingly, made good progress in the gradual transformation (still going on) of the calling of the elementary teacher from a mere routine into a profession. But the increase of the native population and the growth of cities, the enormous and steadily increasing influx of foreign immigrants, the geographical expansion and the much more important and very great commercial and industrial development of the country have been followed by our huge modern schools, our varied and complex programs of studies, our immense city school systems; and hence a host of new educational problems have come into the field,— problems with which the mere classroom teacher of limited academic training and narrow, even if thorough, technical training, is manifestly unable to cope satisfactorily. We have, fortunately, many efficient grammar school principals and superintendents to-day who have had only a normal school training; but in no case are they efficient because their training was originally limited, but in spite of that fact. Moreover, the general public, particularly the educated and the reading public, now take an interest in educational problems heretofore unknown, and this interest is increasing daily. This interest demands satisfaction and seeks educational leaders among the teaching profession as well as good classroom teachers. At the same time it had long been apparent that many college-bred men of excellent scholarship were poor teachers. The college offered them no opportunity to learn how to teach. The problem was to secure, in addition to adequate scholarship, appropriate insight into education and technical skill in teaching. This the college graduate could not and cannot ordinarily secure in the normal school — first, because the normal school was and is naturally and properly concerned chiefly with the training of teachers for elementary schools and, therefore, has generally neither the teaching force nor the equipment to deal separately with college graduates who usually seek preparation to teach in secondary not elementary schools; and second, because it was not and cannot be profitable in most cases to teach in the same classes college graduates and normal school students. The college-bred students are too far ahead of the normal school students in maturity and scholarship to make a satisfactory combination class. For similar reasons the normal schools are generally unable to provide adequate opportunities for teachers already in service who seek preparation for work as principals or superintendents of schools. Out of these considerations arose the university department of education which has undertaken to provide the college graduate with the opportunities he needs for the study of education — whether as a neophyte he is about to begin his professional career as a classroom teacher, or whether as an experienced teacher he returns to the university for the study of his profession under direction with a view to becoming a principal or a superintendent; or whether as an interested layman he seeks enlightenment as to the meaning of education and the means and methods of organizing and directing it as a branch of State or municipal affairs.

The history of the study of education in the colleges and universities of the country is even more brief than the history of that study in the normal schools, for it does not really begin until 1879, when the University of Michigan founded a chair of "the science and the art of teaching" of co-ordinate rank with other chairs or departments. Education before that time (from about 1850) had been studied in "normal departments" established at a number of colleges and universities (more commonly of the Middle West than elsewhere), in which the study of education did not differ materially from that pursued in the normal schools. Such a normal department, for example, existed at Brown University from 1851 to 1854. It was discontinued "in consequence of the establish-

ment in Providence of the Rhode Island Normal School," so says the university catalogue for 1854–55. Another example was the normal department of the University of Iowa, which was, at first (1855), a department of the preparatory school of the university. It had a varied career and was gradually transformed into the present "School of Education" of the university. It exemplifies a not uncommon process of development of these "normal departments" into the university Departments of Education or Schools of Education or "Teachers Colleges" of to-day.

Not infrequently the courses in education instead of being grouped in a department or school of education or teachers college were, and are still, associated with and made a part of the department of psychology or philosophy, usually to the disadvantage of the study of education. This affiliation followed the lead of the German universities and dates from the time — not far back — when "pedagogy" rather than education was the subject studied. It has been found possible, however, in only a few college or university departments of education to solve the problem of technical training for neophytes. Teachers of experience and other persons who resort to the university to study the history and theory of education and the organization and administration of school systems find the instruction of any good professor of education decidedly profitable. But beginners who need to learn how to teach under direction usually fail to get what they most need — the laboratory work of actual teaching and management under the usual conditions that prevail in the classroom. A few college and university departments of education, like the department at Harvard University, have provided such opportunities from almost the very beginning; but, except in some of the larger urban universities, it has generally been found impracticable. But the university department or chair of education has accomplished and is accomplishing a most important task, quite apart from what it may or may not accomplish in the training of young teachers, or in the training of principals or superintendents. It has made education in all its phases a university study. Apathetic and even hostile faculties have slowly yielded the false position that they once held, namely, that among all the fields of human thought and activity education is the only one it is not profitable to study; and this is a great gain. The gradual abandonment of false views concerning the study of education by members of the faculties of our higher institutions has naturally been followed by similar progress on the part of the students. To-day university courses in education are attended by an increasing number of future lawyers, doctors and business men who do not care for the technical courses pursued by future teachers or school officers, but who wish to study the history, theory and, to some extent, the organization of education, just as they study the history and theory of economics — that is, as a part of the proper equipment of a liberally educated man. The university department of education has, therefore, accomplished several important things. It has, at its worst, given college-bred teachers an insight into their future profession which they formerly could not get at all; that is, it has helped to determine a professional attitude and temper of mind of great importance for immediate efficiency and steady professional growth; and, at its best, it has done and is still doing this, and provides, also, actual laboratory work for the young teacher — classroom teaching under direction amid normal surroundings, over a sufficiently long period of time; and it provides suitable training for principals and superintendents of schools on the basis of good instruction and a comparative study, under direction, of schools and school systems in actual operation; and, finally, it has established the study of education among the branches of a liberal education. At the present time more than half of the colleges and universities of the country make more or less provision for the study of education, and many more are preparing to do so. But the development of this study has naturally been more rapid in the State universities than elsewhere, save in the few cases noted above, that is, in the universities that have developed "Schools of Education" of co-ordinate rank with their other professional schools. The scope and general aims of the college or university study of education, as now carried on, may be summarized as follows: (1) To study education as an important function of society as well as of individuals, and hence of interest to all university students whether they intend to become teachers or not. (2) To offer to university students who look forward to teaching the necessary technical training for their vocation; and to teachers already in service, an opportunity to study their profession under direction. (3) To offer to university students who have already had experience as teachers, and to all teachers of suitable age and attainments, appropriate training for future activity as principals or superintendents of schools. (4) To offer opportunities to advanced students for research in the field of education.

While the courses of study offered for the realization of these aims vary greatly, they may be briefly described as courses in: (1) Educational Theory or General Principles of Education, sometimes called "Philosophy of Education," or "Science of Education." The specific aim of these courses is to enable the student to gain a just conception of the scope and meaning of education and to make a critical examination of such generally accepted educational principles as will serve to guide him in his further study of educational questions. (2) Educational Psychology and Child Study. While this subject could be appropriately regarded as a subdivision of the preceding topic, it is usually offered in separate courses, the special aim of which does not differ materially — although the method of treatment does — from similar courses in normal schools. The work done in such courses in colleges and universities is usually more scientific and thorough than in the corresponding normal school courses. (3) General principles of method and special methods of teaching the several school studies, without and with practice teaching, particularly the methods of teaching secondary school rather than elementary school studies. The instruction in the courses in special methods is sometimes given by instructors belonging to the department of education, but often by specialists chosen from

other departments of the college or university. (4) History of education studied as *history*. The purpose is to trace the historical development of modern schools and universities, with especial reference to their ideals, studies, modes of teaching and organization; together with the effect of economic, political, social and religious ideals on the spirit and direction of education; and the influence upon school methods and curricula of the general progress of the arts and sciences. Such a course should therefore give the student a view of the subject in its relation to the history of civilization, as well as a historical basis for sound criticism of the more important elements of modern schools and school systems. (5) The educational importance of play and recreation. (6) Education in practical arts for boys and for girls. (7) The education of exceptional (anæmic or tubercular, crippled, deaf, blind, truant and delinquent, mentally defective) children. (8) Vocational (industrial, commercial, agricultural) education. (9) The vastly important allied subject of vocational and educational guidance for school and college youth and for young people already at work. (10) Organization and management of schools and school systems. The purpose of courses covering this last subject is to study both the internal organization and management of schools and school systems with special reference to the duties of principals and superintendents within a given school or school system, and also the organization and management of education as a branch of State and municipal affairs, at home and abroad. Accordingly, they deal with the appointment or election, organization, powers and duties of State and city boards of education; the powers, duties and opportunities of superintendents, principals and teachers in cities and towns; the work of elementary and secondary schools, including the construction of programs ("courses") of study; and, in general, everything pertaining to the organization and efficient administration of our vast, complex and costly provision for public education; and sometimes also a similar study of foreign schools and school systems. Such courses sometimes also cover the organization and management and the work of private and endowed schools. (11) School hygiene; the hygiene of school buildings and the hygiene of the pupils. (12) Seminary courses or research courses. Such courses offer opportunities to the most advanced students for prolonged study of particular educational questions. As the whole field of educational theory and practice abounds in unsolved problems and vast areas in the history of education are as yet untouched, it is easy to see how important such courses are. Not all of these courses are found in every college or university department of education, but they are all found in some of them; and in the university schools of education, to which reference has been made, all these courses are offered and elaborated with a minuteness of differentiation that should eventually promote a very thorough study of the topics involved.

Progress in the study of education has been greatly facilitated in recent years by the rapid growth of a considerable body of good educational literature both in books and periodicals is still common, a large number of good books have been published in recent years and several periodicals have appeared worthy of a place beside the best educational literature that has been produced anywhere.

In addition to the study of education already described, mention should be made of the study of education carried on by educational associations. The National Educational Association is not only a vast forum for the discussion of educational questions, but since 1893 it has stimulated and subsidized educational research through committees appointed to report on selected problems. Several of the reports submitted by these committees have been of great value and more may be expected in the future. The State teachers' associations and other local associations throughout the country also occasionally carry on educational investigations of more than local significance. Mention must also be made of the studies in education now undertaken by associations of laymen and by some of the non-professional magazines.

Recent and very important developments in the study of education may be described as statistical and experimental studies of educational procedure and approximately scientific studies (quantitative measurements) of educational results. The purpose of these studies is to obtain objective standards whereby contemporary educational procedure can be directed and results measured with an accuracy approximating the direction and measurement of results in the natural sciences; and thereby to confirm or refute (as the case may be) educational opinion. Such standards, when attained, constitute unassailable guidance for educational practice, which, for the most part, we now lack. The most promising standards thus far attained are in the field of elementary education — arithmetic (computation with whole numbers), penmanship, spelling and reading. The study of education in the past has been based almost wholly on individual experience, and especially on the opinions of prominent individuals — laymen and teachers. Such individual experience and opinion will always be worth studying, but the conviction that scientific research in education is essential to satisfactory progress, which has been slowly forming during the past decade, is now firmly established in the professional mind; and the statistical and experimental studies and the measurement of educational results above referred to are the result. The literature of this important development in the study of education is growing rapidly. Apart from books, such studies are energetically promoted by several contemporary periodicals and by researches carried on by colleges and university departments and schools of education, working independently, but often in co-operation with progressive supervisory officers and teachers in neighboring school systems. The conviction that such studies are essential to progress in education has also led to the establishment of departments of research in about a dozen of the larger school systems of the United States. Such departments serve the same purpose in school activities that research departments and departments of design serve in industry and commerce. That they do serve such purposes, several of them have already proved.

Many important studies of entire school sys-

tems, called *school surveys,* have been made by specialists usually not connected with the systems studied on the invitation of State, city and rural school authorities. The reports of these surveys, now numerous, constitute a vast mine of information for all students of education; indeed, the student of education in the United States will find no more important body of educational literature than is embodied in those reports.

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EDUCATION, Supplemental. See SUPPLEMENTAL EDUCATION.

EDUCATION, Technical. Technical education is a very modern form of educational enterprise which is concerned with the training of men to make an organized practical application of a knowledge of the principles of chemistry, physics (especially mechanics, heat and electricity), mathematics, astronomy and bacteriology to the design, construction and operation of machines, structures of all kinds, and the material conveniences of life. It aims to produce men of broad understanding of the field of applied science, who have insight, organizing power and leadership, not merely surveyors, draughtsmen or superintendents. Viewed in this light it is an important new phase of professional education (see EDUCATION, PROFESSIONAL), always mindful of the need of increased production, but distinguished from industrial education (see EDUCATION, INDUSTRIAL), which is designed primarily to prepare men and women for maximum production with a minimum expenditure of time and human energy. Broadly speaking, technical education is engineering education, but the term engineering now includes a variety of divisions which would have been entirely incomprehensible to the founders of the early schools of applied science; it applies rather to the expert direction of organizations which utilize the forces and materials of nature through large combinations of human units than to the actual labor of production. In addition to the usual branches of engineering — civil, electrical, mechanical, mining and architectural — there must now be included chemical, railway, marine, ceramic, sanitary, textile, agricultural, metallurgical and aeronautic engineering.

The scheme of technical education for all of these specialized engineering professions provides for firm grounding of the student in the processes of the fundamental pure sciences appropriate to the specialization, whether chemical, ceramic, textile or aeronautic. In the usual four-years technological course leading to a Bachelor's degree this is accomplished largely in the first two years, in which instruction in mathematics, chemistry, physics, surveying, etc., is given, sometimes by basing the two-years engineering curriculum upon two years of liberal arts, as in the University of Missouri. In the case of five-years engineering courses or six-years combination courses the fundamentals may occupy the first two years or the first three years as in the Columbia School of Mines, in which the three-years technological courses in mining, engineering and chemistry are based upon the three years of study in a collegiate or scientific school. After these fundamental sciences and additional instruction in English, economics, politics, etc., the curriculum of the last two or three or four years of technical courses follows divergent lines of study preparatory to the practice of specialized engineering professions, which aim to meet corresponding specialized demands arising out of the unparalleled development of mechanical, structural and industrial needs of a nation of 110,000,000, complex in its interests, rich in its resources and impatient in its development.

The first school of engineering in the United States was the Rensselaer Polytechnic Institute (q.v.), founded at Troy, N. Y., by Stephen van Rensselaer in 1824, as a School of Theoretical and Applied Science, to furnish "instruction in the application of science to the common purposes of life." No further provision of the kind was made until 1847 when the Sheffield Scientific School at Yale and the Lawrence Scientific School at Harvard were founded. In the same year the University of Michigan voted to establish a course in civil engineering. These four schools, concerned almost exclusively with civil engineering, were the only schools of the kind opened before the Civil War. After the passage of the Morrill act in 1862 (see EDUCATION, AGRICULTURAL) many States accepted the provision of the act and proceeded to organize new schools of agriculture and the mechanic arts, or to add these types of technical education to existing schools. Many of the State universities, like Illinois, Wisconsin and California, which now offer strong and well-equipped instruction in technical lines received very large impulse from the Morrill act. The great expansion of construction and industry after the Civil War caused the rapid multiplication of engineering schools. The four schools of 1860 increased to 17 in 1870, 41 in 1871, 70 in 1872, 85 in 1880 and 126 in 1917; the graduates numbering 100 in 1870 reached 4,300 in 1917. Besides these schools there are 43 other institutions giving more or less attention to engineering work, either in the form of "two years of engineering" or of single courses like civil engineering in connection with other curricula. Of the 126 schools of 1917, 46 were connected with land grant colleges, 44 were professional schools in universities, 20 were attached to colleges and 16 were independent. Midway between the group of technical schools and industrial schools are to be found certain excellent institutions giving more or less technical or engineering education to men and women, for example, Pratt Institute in Brooklyn, Lewis Institute in Chicago and the Cogswell Polytechnic Institute in San Francisco.

Following the period of rapid multiplication of technical institutions from 1870 to 1890 came a period of standardization of requirements for admission and for graduation, for it was clear that technical education was not a simple problem with an easy and uniform solution, especially if the engineer was to become the professional equal of trained lawyers and doctors. The formation of the Society for the Promotion of Engineering Education in 1893 and the organization of the joint committee on engineering education of the national engineering societies in 1908 promoted the process of elevation and standardization of curricula. By 1917 practically all of the first class technical schools required at least four years of high school work

for admission and at least four years of collegiate work for the specialized degree, whether that of B.S. in some division of engineering, as Bachelor of Science in Mechanical Engineering (B.S. in M. E.), Bachelor of Civil Engineering (B.C.E.) or Civil Engineer (C.E.). With few exceptions, e.g., Massachusetts Institute of Technology, the technical schools, like other colleges, receive their students out of the great system of public secondary schools by certificate rather than by examination. Students thus received are given approximately the same work during the first year with later differentiation as discussed above. The extent of this specialization is illustrated in the curricula offered at the University of Illinois and the Massachusetts Institute of Technology.

UNIVERSITY OF ILLINOIS.

Degree of B.S. in special curricula: architecture, architectural engineering, ceramic engineering, civil engineering, electrical engineering, mechanical engineering, mining engineering, municipal and sanitary engineering, general engineering, physics, railway civil engineering, railway electrical engineering and railway mechanical engineering.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Degree of B.S.: civil engineering, mechanical engineering, mining engineering and metallurgy, architecture, chemistry, electrical engineering, biology and public health, physics, general science, chemical engineering, sanitary engineering, geology, naval architecture and marine engineering, electro-chemistry and engineering administration. Further specialization is permitted within these courses in the Massachusetts Institute of Technology, for example, in mechanical engineering along the lines of engine design, locomotive engineering, mill engineering and steam turbine engineering.

A summary of the requirements for admission and the curricula for graduation, for the course leading to a degree in mechanical engineering in the Massachusetts Institute of Technology, the Rensselaer Polytechnic Institute and the University of Illinois will serve as an illustration of the standardized technological course in an institution of the highest class. The specifications for admission are given in terms of units (one unit is approximately one-fourth of the work of a high school year).

ADMISSION REQUIREMENTS.

	Massachusetts Institute of Technology Admission by examination	Rensselaer Polytechnic Institute — Admission by certificate or examination	University of Illinois — Admission by certificate or examination
Algebra	1½	1½	1½
Plane geometry	1	1	1
Solid geometry	½	½	½
English Composition and Literature	3	3	3
Physics	1	..	..
Laboratory science	..	1	1
French	2	..	..
German	2	..	..
Foreign Language	..	2	..
History	..	1	..
Electives	3–4	4	..
Electives (five from history, foreign languages, mathematics and science)	..	..	8

CURRICULUM IN MECHANICAL ENGINEERING.

Massachusetts Institute of Technology	Rensselaer Polytechnic Institute	University of Illinois
Mathematics	Mathematics	Mathematics
English	English	English Comp.
Foreign Languages	French	Language
Chemistry	Chemistry	Chemistry
Physics	Physics	Physics
Drawing	Drawing	Drawing
Mechanics	Mechanics	Mechanics
Electrical Engineering	Electrical Engineering	Electrical Engineering
Mechanical Engineering (about 20 specialised courses)	Mechanical Engineering	Mechanical Engineering (about 16 specialized courses)
General Studies (History, Economics, Business Law)	General Studies (Astronomy, Contracts)	Non-technical electives
	Metallurgy	Engineering lectures
	Surveying	Instruction trips
	Hydraulics	
	Naval Architecture	
	Summer Shop Work	
	Theses	

The proportions between shop work, or practice work, and theoretical work in the curriculum of technical schools, vary widely in different institutions and at different times. The most progressive have abandoned the requirement of many hours of manipulative laboratory work and the production of completed machines, and now require sufficient shop work for an understanding of the processes and tools, but without insistence upon the attainment of skill. On the other hand there is stronger and stronger emphasis upon the mastering of the fundamental subjects and theory behind the technical courses. Many strong institutions like those whose curricula are given above require also a considerable proportion of liberal, non-technical study in order to develop the man as well as the engineer, so that the student who graduates from the institution shall understand the importance of both the human and the technological factors which enter into the practice of his profession. In place of the narrow technical education of 1890 or 1900 with slender foundation in the sciences and the inclusion of large quantities of shop practice, technical schools now seek to develop at the same time an accurate working knowledge of the principles and practices of engineering subjects and personal qualities of judgment, initiative, responsibility and an understanding of men. Such a curriculum as that noted above in engineering administration requires quite as much knowledge of "human engineering" as of mechanical or chemical engineering.

The co-operative type of technical education, sometimes known as the Cincinnati co-operative plan, is the most recent attempt to co-ordinate theory and practice under conditions approximating those of the shop and of the field. First formulated in 1899 by Hermann Schneider when instructor at Lehigh University, it had its beginning in 1906 at the University of Cincinnati which established under his direction a co-operative agreement with industrial plants, railways, etc., by which students who are admitted to the university, as are other students, work on a schedule by which, during bi-weekly periods, one-half of the class is at the university, and one-half is in the factory. During the next period of two weeks the sections change about. The co-operative course is of five years' duration, 11 months in the year. While in factory or

shops students are regular employees, receive regular pay and must report satisfactory service in the shops as well as in the classrooms in order to be continued in the university. The co-operative plan has been adopted at other technical institutions, and in some cases by secondary institutions, which are advantageously located near shops and industrial plants of various kinds, with which co-operative arrangements may be made. It is claimed that this combination of scientific and theoretical study at the university with practical experience results in a better mastery of facts and of manual skill since it is secured under conditions which compel a maximum of independent thinking along with an appreciation of the social significance of the studies and the practice.

Technical education has its upward reach into graduate courses for professional degrees like Civil Engineer (C.E.), and Master of Civil Engineering (M.C.E.); organizations for research like the Engineering Experiment Station of the University of Illinois, the Federal Forest Products Laboratory located at the University of Wisconsin and the Mellon Institute of the University of Pittsburgh; and investigations in subjects like industrial chemistry leading to the Ph.D. in great graduate schools which are not organically parts of a technological college, as at Cornell University and the University of Chicago. The steady emphasis of the stronger technical schools upon investigation and contributions to the solution of intricate new problems is one of the latest and most significant aspects of technical education in the United States and in Europe.

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EDUCATION, Theological. A system of training for the work of the ministry. From remotest times religion centred in ritual acts and gave rise to a system of training men to fill the office of the necessary priesthood. The priests of the great temples in ancient Babylonia, Egypt and other lands, as well as those at the prehistoric shrines, naturally took pains to train young men to perform the duties of the sacred office which eventually they had to surrender. When religion consisted in the main of the public performance of ritual acts the training of the priest was a simple affair. It consisted, of course, in imparting a knowledge of the principles underlying established practices but mostly it was a course of ritualistic instruction. The case of Samuel (1 Samuel c. i ff) brought up at the shrine of Shiloh is an illustration of this early sort of training for the priesthood. When religious systems clashed in a strife for supremacy in the world, the priest had not only to administer the ritual of the altar but to defend and proclaim the doctrines of his faith with converting power. This was conspicuously the situation when Christianity sought to get a foothold. Among the early Christians the preaching of doctrine outranked the performance of ritual. With the increasing importance of doctrine a fuller and more thorough instruction on the purely intellectual side of religion necessarily entered into the preparation for the ministry. During the first few centuries of Christian history individual enthusiasm was so intense that the ministry was adequately supplied by men who in a sense were self-educated, self-prepared. As churches multiplied and the need of uniformity in Church teaching and practice became more urgent, systematic efforts had to be made by the bishops to train men to fill the priestly offices. The simplest and surest way was for the bishops to take young men into their own homes and educate and train them. In New England it was for a long time quite the common thing for young men who thought of entering the ministry to take up residence with a regularly ordained clergyman and read divinity with him very much as a young man preparing for the law entered the office of a lawyer and read law there. Eventually the monasteries became the training schools for priests and the universities naturally became a place of theological education. Down to as late a time as the Council of Trent theological training was in an exceedingly chaotic condition, a condition greatly emphasized by the events of the Reformation. One of the steps taken by the Catholic Church to meet the situation of this stormy period was the establishing of the theological curriculum for the diocesan seminaries, a curriculum which has continued practically unchanged to the present time. In Europe where the Protestant religion became the religion of the state Protestant theological education was from the first provided by the great public universities. The Protestant denominations dissenting from the established Church provided schools of their own.

The United States.—The earliest educational institutions in New England were theological in purpose and inspiration as is evident from a contemporary account (1643) of the founding of Harvard University: «After God had carried us safe to New England and wee had builded our houses, provided necessaries for our livelihood, rear'd convenient places for God's worship, and settled the civill government: One of the next things we longed for and looked after was to advance learning and perpetuate it to posterity; dreading to leave an illiterate ministry to the churches, when our present ministers shall lie in the dust.» That this purpose might be doubly ensured against miscarriage free tuition was offered to candidates for the ministry, while students for other purposes were charged a fee. This practice has been almost universally followed. These early institutions did not confine themselves to the teaching of theological subjects and by the end of the 18th century secular students had so outrun divinity that it became necessary to create within these old universities separate schools of theology. When toward the end of

the 18th and the beginning of the 19th centuries different denominations began to establish their own theological seminaries there was manifest a widespread desire to isolate these schools from all institutions of higher learning by building them at considerable distances from such institutions. This guarded against secularization and helped to make the minister a more ardent denominationalist. Of the existing theological schools three were established before the 19th century: the seminary at New Brunswick, N. J., of the Dutch Reformed Church, founded in 1784; the Roman Catholic Seminary of Saint Mary's, Baltimore, Md., 1791; and the United Presbyterian Seminary, established 1794, at Service, Beaver County, Pa., and later removed to Xenia, Ohio. Later other denominations established seminaries. The first Congregational seminary was opened in Andover, Mass., 1808 (now located in the neighborhood of Harvard University). The Protestant Episcopal Church founded its first seminary in New York city in 1819. At Hartwick Seminary, N. Y., the Evangelical Lutherans built their first theological school in 1815; Colgate Seminary, now a part of Hamilton College, was established by the Baptists in 1820; at Newbury, Vt., the Methodist Episcopal Church opened its first theological school in 1841; this school is now a department of the Boston University. In 1819 the divinity school of Harvard University was organized as a separate institution and became the first non-sectarian divinity school in the country. During the first 25 years of the 19th century 18 seminaries were organized representing 11 denominations. Four of these were Presbyterian; three Congregational; Baptist and Protestant Episcopalian 2 each. The period of greatest activity in establishing theological schools was from 1850 to 1875, 71 being the number of new schools founded. Of the 169 theological schools reported by the United States Commissioner of Education for the year 1916 26 were organized after 1899. Of the 165 seminaries reported in the statistics of 1899, 38 are not found in the statistics for 1916, having disappeared by amalgamation or otherwise. The 169 theological schools reported in 1916 represent 27 denominations. (For statistics see EDUCATION, PROFESSIONAL). In 1916, seven were listed as non-sectarian, four as interdenominational, three had no sectarian designation. Since the beginning of the 20th century three important theological schools have abandoned sectarian designation: Union Theological Seminary, New York city, changed its designation from Presbyterian to interdenominational; Yale from Congregational to undenominational; the theological school of Vanderbilt University, Nashville, Tenn., from Methodist Episcopal to non-sectarian. Of these 169 schools 41 admit both men and women. In 1898 1,693 were graduated from 165 schools and in 1916 2,088 were graduated from 169 schools. The practice generally followed for over a century was to establish theological schools fairly remote from other institutions of higher learning. It has come to be recognized that this practice has seriously impaired the scholastic and practical value of these schools. The past 20 or 25 years has witnessed an increasing movement toward bringing these schools into closer touch with colleges and universities. As instances of this, the moving of Andover Theological Seminary to Cambridge, Mass., and its affiliation with Harvard; the affiliation of the Chicago Theological Seminary with Chicago University; the arrangement effected by the Meadville, Pa., Theological School to send its students to the Chicago University for a part of their course may be cited. A century ago the importance of this plan was recognized by Thomas Jefferson and advocated by him in his report as rector of the University of Virginia.

Roman Catholic.— In the diocesan seminaries for the training of men for the priesthood the curriculum of to-day is but little changed from that outlined by the Council of Trent. The course extends over a period of six years divided into a philosophical course of two years followed by a theological course of four. Candidates for admission to the seminary must offer a B.A. from some college of recognized standing or a satisfactory equivalent. This latter provision is made so that the Church may not lose the services of a man peculiarly fitted by nature for the office of priest who has not been able to secure a collegiate training. Unlike Protestant seminaries, where the courses of like subjects are by no means the same even in schools of the same denomination, the courses are alike in all Catholic seminaries though the quality of scholarship may not be uniform. The first two years are devoted to logic, ontology, psychology, natural theology, Church history, general history, Old and New Testaments, Latin, Hebrew, Greek, science, biology and chemistry. The purpose of science in this curriculum is well explained by Leo XIII: "It is enough that their (the seminaries') pupils have an accurate knowledge of the main principles and summary conclusions (of physical and natural sciences), so as to be able to solve the objections which infidels draw from these sciences against the teachings of Revelation." These two years are designed to furnish a sufficient preparation for the rigorous and intensive study of theological subjects of the next four years. The subjects pursued are apologetics (an exposition and defense of the grounds of Catholic beliefs), dogmatic and moral theology (the aim of moral theology is to prepare the future priest for the competent and practical care of souls, teaching him how to judge and estimate the morality of the actions of those who may fall within the province of his direction as a priest and confessor), pastoral theology (the proper care and government of the charges entrusted to him and the faithful and successful discharge of his sacred ministry), homiletics, canon law, Church history, biblical exegesis. Sociology is a seminary subject and is intended to afford an opportunity for the students who so wish to secure a thorough knowledge of modern social and economic problems and movements. By constant participation in the ritual the young priest is trained to the proper administration of the Church's sacraments. Similarly the student is prepared to organize and manage the Church's many social activities through service in those societies which have to do with the immediate work of human helpfulness.

Jewish.— Theological education for the Jewish ministry differs somewhat from the Christian scheme. The course at Hebrew Union College extends over a period of nine years — four years preparatory and five years in the

collegiate department. In the preparatory department the students are given a thorough grounding in the grammar and vocabulary, which enables them to read the unpunctuated text of the Pentateuch and other Hebrew literature. A general knowledge of Rabbinical literature and history of the prayerbook and Psalms and the doctrines and ceremonies of Judaism is also aimed at. The collegiate department is divided into two parts, "the three lower grades being devoted to the acquisition of material and the upper two to systematic and specific theological knowledge." The principal subjects of study are Bible Exegesis and the Talmud and all the important Hebrew literature, as well as the New Testament; the history of the Jewish people. The study of the origin and development of Mosaic and Rabbinical Judaism paves the way to systematic theology. The study of comparative religions is pursued to give a foundation for Jewish apologetics. Practical theology divides itself into the study of homiletics and the rites and ceremonies of Judaism. Ethics and pedagogy are important subjects, the latter being designed to prepare the student for the task of religious instruction. Applied sociology or the science of philanthropy forms a part of the curriculum, and is designed to teach the rabbi "how to combine the new method with the ancient spirit of Judaism in the field of practical righteousness and Social Service."

Autumn	Winter	Spring
	First Year	
Beginnings of Old Testament, literature and history.	Old Testament, history and prophecy.	Old Testament, history and Judaism.
Church history — The ancient Church.	Church history — The Reformation.	Church history — The development of modern Christianity.
Practical sociology — The Church and society.	Practical theology — Religious education.	Practical theology — The organization of the Church.
Practice in observation and public speaking.	Public speaking and music.	Public speaking and music.
	Second Year	
New Testament — Jesus in Jewish history.	New Testament — Primitive Christian life and literature.	New Testament — Teachings of Jesus.
Systematic theology I.	Systematic theology II .	Systematic theology III.
Practical theology — Theory of preaching.	Practical theology — Preparation and delivery.	Practical theology — Problems and methods of Church extension.
	Third Year	
Sequence courses in the student's principal department and electives under the direction of his faculty adviser.		

Protestant.— In the education for the Protestant ministry the strictly theological subjects differ little from the major subjects in the Catholic curriculum. Systematic, dogmatic, practical theology, exegesis, church history and homiletics — these for many generations were the sum of Protestant theological education. A recent writer has summarized the instruction given in the leading theological schools until recently in such a way as to indicate the different values assigned to these subjects. Out of a possible 1,536 hours of study the time is actually divided in this way: Theology and apologetics, 480 hours; Hebrew and Old Testament, 288 hours; Greek and New Testament, 224 hours; ecclesiastical and Biblical history, 256 hours; preaching and social problems, 96 hours; rhetoric and elocution, 144 hours. A word or two by way of explanation will help to a better understanding of the actual significance and purpose of these studies. The study of Hebrew is designed to enable the student to get the text of "the divine law and covenant." Greek is required that he may get "the letter of the New Covenant and the precise word of the latest inspiration." Dogmatic theology "weaves into a single system the separate strands of truth gathered from Scripture" and tradition. Apologetics is studied that the preacher may go out equipped to defend "the established doctrines against critics and heretics." The study of Church history acquaints the student with "the way in which previous dogmatic theologians have done their work; including the forms and institutions in which the Christian truth has found embodiment." Homiletics "is the art of fitting a doctrine to a text and proclaiming it convincingly." Practical theology is studied to prepare the student to conduct and administer properly the services of the particular Church the ministry of which he is to enter. While in a considerable number of theological schools this is the extent and character of the education given in these days, the modern minister must come to his position prepared to manage, initiate, inspire many secular or semi-secular enterprises as well as fill the place of a spiritual administrator. The services of worship and spiritual instruction have become the smaller part of a minister's activities. There are men's clubs, girls' societies, boys' clubs, reading-rooms, gymnasiums, banquets, sociables and many other activities designed to aid in the development of community life. In response to these new demands the theological seminaries are radically changing their curricula, not by abolishing the old subjects but by the addition of new ones, or rather by changing the rank of the subjects — studying the old subjects from an entirely different angle. To quote from one seminary's catalogue, "The social teachings of the Old and New Testaments are studied with the purpose of estimating the nature of the contribution of Biblical history and theology to moral and social progress." The sociological now ranks with and in some cases ahead of the theological in an increasing number of schools. The much-debated question whether Hebrew and Greek should be required is being answered by putting these subjects in the elective groups. In some instances students are allowed to present themselves as candidates for the degree of B.D. by offering as substitute for Hebrew and Greek a satisfactory "acquaintance with scientific, philosophical, or historical method." The course on "Social Ethics" offered by the Divinity School of Harvard University is a good illustration of how the theological schools are trying to educate the minister to meet the

problems which confront the clergyman of to-day. The subjects explain themselves. «Social Problems in the Light of Christian Ethics,» «The Development of Modern Philanthropic Theory and Practice,» «The Minister's Relation to Social Agencies,» «American Population Problems,» «The Housing Problem,» «Unemployment and Related Problems,» «Rural Social Development.» The intimate association of the theological schools of Chicago with the Chicago Commons Social Settlement and the Chicago Institute of Social Service are indicative of the attempts now made to educate the minister by introducing him while in the seminary into the midst of the complex human problems — a sort of sociological clinic. The preceding table presents a brief survey of the course of study planned out for a candidate for the ministry in some of the leading Protestant seminaries.

The emphasis in much of theological education to-day then is put on «Psychology, sociology, philanthropy, legal principles, and practical problems involved in applying the spirit of Christianity to modern life.» In some schools the comparative study of religions is given an important place, on the ground that the more one knows of the religious systems of the world the sounder is one's understanding of his own religion.

Two recent developments deserve fuller mention than can be made here. A few words from the charter of the Hartford Seminary Foundation (1913) are to the point (this is the reincorporation of the old Hartford Theological Seminary). The object of the Seminary Foundation in addition to preparing men for the ministry is said to be «to train men and women for the work of religious education in all its branches and for such other callings and forms of service as seek to promote Christian worship and work; to train men and women for service in such institutions as are established for the social welfare of mankind in the name and spirit of the Christian faith; to train men and women for service in the foreign field.» To this end there has been added to some of the seminaries a school of religious pedagogy which aims to offer its theological student fuller opportunities to prepare himself on the Sunday school and social service work of the church, and also to educate men and women to fill what might be called the office of assistant to the pastor. A school of missions has been added to give those who plan to enter the foreign field a chance to specialize in studies peculiarly fitted to that end. Another feature is the summer schools of theology, which offer to men already in the regular work of the ministry an opportunity to pursue the old seminary studies or take up new ones in the hopes of better fitting themselves for the tasks met with in their parishes. The work pursued in these summer schools, conducted by several of the leading seminaries, may be credited toward a degree. Another and not less useful innovation is the correspondence courses in theology carried on by a few of the seminaries. These correspondence courses afford the man in the field an opportunity to secure the education he feels in need of under the guide of competent instructors. In some instances the work done in these courses may be credited toward a degree. All this is simply indicative of the desire on the part of the seminaries to create a finely educated ministry for the churches.

The question of educational qualification for admission to theological seminaries has been pretty thoroughly debated for many years. While there is evidently a constant stiffening of these requirements, a college training being more and more in demand, it is felt now, as it has been all along, that the terms of admission should be flexible enough to let in persons who, lacking collegiate training, nevertheless have intellectual and spiritual qualifications which make them desirable additions to the ministry. To compensate for this lack of scholastic preparation most of the seminaries provide courses in essentially preparatory subjects, and so pass these students on into the regular courses or else the students are admitted to special courses. However, many of the seminaries award degrees only to those who enter with a collegiate degree; though usually any student is allowed to present himself as a candidate for the degree if he submits evidence of scholarship fully equivalent to a college training. In most instances tuition is free in the theological schools, and financial assistance is readily granted to needy students. This has been severely criticised. But whether it deserves the criticism or not, it is difficult to break up a long established custom and one that has been productive of some excellent results.

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EDUCATION, United States Bureau of, a bureau under the Department of the Interior since 1868, whose chief activities are given to the collecting and dissemination of educational information. It was originally created a department by act of Congress 2 March 1867. But the opposition of the States was so pronounced against the interference of Congress in educational matters that the newly-created department was reduced to a bureau the following year and its province limited almost altogether to the encouragement of education through the collection and dissemination of educational information. The work of the bureau naturally fell far short of that done by the Department of Education in countries where such bodies are given the direction of educational matters for the whole nation. In 1864 efforts were made by teachers and others interested in the advancement of education for the establishment of a Bureau of Education. But owing to the attitude of Congress and the various State legislatures, which were unanimous in their agreement to leave all educational matters in the hands of the State officials, the Bureau of Education was not taken very seriously by the United States government and its efficiency was hampered by a lack of funds and of freedom of action. The bureau began to make its efforts more concrete and effective by the issuance of 'Annual Reports.' In 1870 a series of 'Circulars of Information,' dealing for the most part with the history of educational progress in the various States of the Union, more especially from 1888 to 1903, indicated increased activities. A step in advance was made in 1906 by the institution of the 'Bulletins' dealing with a wider variety of interesting educational subjects. In 1910 the bureau broadened the scope of its work still more by the publication of 'Circulars of Infor-

mation' containing digests of current legislation and interesting accounts of new educational features of city and State school systems. The work of the bureau is divided among six subdepartments or administrative divisions and its activities cover higher education, school administration, rural schools, vocational education, kindergartens, home education, immigrant education, civics, education of racial groups, home and school gardening, commercial education, school hygiene, community organization and foreign educational systems. The necessities of the European War increased the activities of the bureau and broadened its field of action. At the close of the fiscal year 1916–17 the staff of the bureau consisted of 76 regular employees in Washington, five in Seattle and 118 special collaborators. The office force included at this date a commissioner of education, chief clerk, specialist in higher education, editor, statistician, specialist in charge of land-grant college statistics, two translators, collector and compiler of statistics, specialist in foreign educational systems and another in educational systems. The Congressional appropriation made to the bureau for the year 1916–17 was $405,500 and for the following fiscal year $431,800, a sum inadequate for the proper extension of its work.

The *Annual Report of the Commissioner of Education* is issued in two parts. Part one consists of "a comprehensive, interpretative review of the more important phases of the progress of education in the United States and all other countries"; while part two is a statistical summary of the schools and other educational agencies of the United States.

Under the control of the United States Bureau of Education, through its commissioner, is the administration of the schools for natives in Alaska, to the maintenance of which goes more than half the appropriation received by the bureau.

During the fiscal year 1916–17 the bureau collected statistics from 48 States, and 1,241 city school systems, 574 universities and colleges, 530 professional schools, 1,322 training schools for nurses, 278 normal schools, 734 summer schools, 12,003 public high schools, 2,203 private high schools and academies, 912 commercial schools, 397 schools for negroes, 121 State industrial schools and reformatories, 61 institutions for the blind, 159 schools for the deaf and 178 schools for the feeble-minded.

The library of the Bureau of Education claims to be the most extensive library in the United States, devoted exclusively to education. It contained in 1917 about 150,000 volumes and pamphlets; and these were being added to yearly to the extent of 15,000 or more. Consult *Report of the Commissioner of Education* (Washington, published annually).

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EDUCATION OF THE BLIND. See BLIND, EDUCATION OF THE; EDUCATION OF THE PHYSICALLY HANDICAPPED.

EDUCATION BOARD, General. This board was founded in New York city in February 1902 and chartered by Congress on 12 Jan. 1903, its object being the promotion of education throughout the United States, without distinction as to race, sex or creed. Beside gifts from several philanthropists, the board received, when chartered, a special gift of $1,000,000 from John D. Rockefeller for carrying on the work in the Southern States. Upon the assurance of the success of this movement, on 30 June 1905 he made an additional gift of $10,000,000 and in 1907 a further sum of $32,000,000. See GENERAL EDUCATION BOARD.

EDUCATION OF CRIPPLES. See EDUCATION OF THE PHYSICALLY HANDICAPPED.

EDUCATION OF THE DEAF. See DEAF; DEAF, EDUCATION OF THE; DEAF-BLIND; EDUCATION OF THE PHYSICALLY HANDICAPPED.

EDUCATION OF DEFECTIVES. See BLIND; DEAF, EDUCATION OF; EDUCATION OF FEEBLE-MINDED, etc.

EDUCATION OF THE DUMB. See DEAF; EDUCATION OF THE PHYSICALLY HANDICAPPED.

EDUCATION OF FEEBLE-MINDED OR MENTAL DEFECTIVES. In the classification of children of this type it is necessary to distinguish the mentally retarded or backward child from the feeble-minded or mentally defective child. There is a large percentage of the children in attendance upon school who are behind the grades in which children of their ages should be found in school work. There are legitimate reasons for many of these children being behind their proper grades. Some are foreigners and were not able to use the English language when they entered school. Others started in school late. There are those who have poor sight or defective hearing or who are suffering from some other physical defects as adenoids, poor health, etc., which interferes with the performance of their school work. When there is no apparent reason for a child being three years below his proper grade or when he fails to make progress after the removal of such physical defects as he may have had, the probabilities are that such child is feeble-minded. When the mental development of such child is so arrested as to render him unable to advance in his school work, he is regarded as feeble-minded or mentally defective. It is, therefore, a serious matter to classify a child as feeble-minded. Such classification places a stigma upon the child which may be unjust and from which he may never recover. The average classroom teacher or school principal should not, therefore, undertake to determine that a pupil is feeble-minded. The study of the mental development of children by persons scientifically trained for that purpose has resulted in the establishment of certain tests which are now quite generally accepted as the measure of a child's mentality. No child should, therefore, be classified as feeble-minded who has not been examined by an expert and found to be of such type. If any question of doubt exists the child should be given the benefit of that doubt. By the application of these tests it may be found that a child 12 years of age has the usual mental development of a child of four; or a man of 40 years of age may have the mind of a child eight years of age, etc. The feeble-minded are, therefore, classified as children of various ages. From these tests three general classes have been established. These are the idiot, the imbecile and the moron. The idiot is the lowest in the scale of intelli-

gence, the imbecile is the next higher and the moron is the highest.

The importance of the subject of feeble-mindedness will be appreciated by considering the number of feeble-minded in the country. There has been no general census in Europe or in this country which reveals the exact number of feeble-minded adults or children. Various studies and surveys have been made, however, under government direction and by reliable organizations interested in the subject which show the number of feeble-minded persons within a given area and a specified population. From the information which has been obtained through these investigations and surveys, it is possible to make a fairly accurate estimate of the number of feeble-minded people and also the number of feeble-minded children in the country.

The Royal Commission of Great Britain made surveys in several sections of England, Ireland and Scotland and gave the subject careful thought for four years. Its report was made in 1909 and showed that, on the basis of its study, 1 in every 217 persons in England was feeble-minded. Surgeons of the United States Public Health Service completed a survey of the feeble-minded school children in Porter County, Ind., in 1915, which showed that .955 per cent of all the children in that county were feeble-minded. The same authority made a survey of Newcastle County, Delaware, in 1916, which showed that 1.3 per cent of all the children examined were feeble-minded. A survey made by the Nassau County Association assisted by the National Committee for Mental Hygiene, the United States Public Health Service and the Rockefeller Foundation, in Nassau County, N. Y., in 1916, showed that on the basis of its study, 1 person in every 183 of that county was feeble-minded. The investigation by the Massachusetts Society for Mental Hygiene in that State in 1914 indicated that there was one feeble-minded person in every 278 of the population. The estimates made by such experts as W. E. Fernald, H. H. Goddard and E. R. Johnstone place the number of feeble-minded in the United States at 1 in every 250 persons. Applying these figures and the estimate of the Committee on Mental Hygiene and the New York Committee on Feeble-Mindedness to the population of the United States, we should have in this country about 400,000 feeble-minded persons and about 100,000 feeble-minded children. The presence of this large number of feeble-minded children in the country at large is a condition which demands that every effort possible be made to educate and train as many of these as may be possible in order that they may be self-supporting. It is estimated by Mr. George Hastings, secretary of the New York Committee on Feeble-Mindedness, that about "one-third of the feeble-minded break the law and nearly one-third of the law breakers are feeble-minded."

About 1850 the States began to give consideration to the education of the feeble-minded child. State institutions were organized and the care and education of this type of child has received extended consideration since that time. Many State institutions and several private institutions have been established for the care, education and training of children of this type.

It is not feasible to undertake the education of the classes of mental defectives known as idiots or imbeciles in the public school. These types of mental defectives must generally receive their training in institutions established in accordance with modern scientific standards for the education and care of such children. The children who are classified as morons may be segregated and educated in special classes provided for them in the public schools. Mentally defective children who come from homes which are able to give them proper care when they are not under the influence of the school and who may be trained to become either wholly or partially self-supporting may generally be afforded necessary educational facilities for their proper education in the public school system of the city or district in which they live. All mentally defective children who come from homes which cannot give them the protection and care which is essential to the best interests of society should be educated in institutions organized for this type of children. The tendency throughout the country is to utilize to the greatest extent possible the public school system for the education of this type of children.

There has been recent legislation upon this subject in the States of New Jersey and New York. In 1911 the legislature of New Jersey enacted a law making it the duty of the State board of education to ascertain the number of children in the public schools of the State who were three years or more below the normal grade. This law further provides that in each district in which there are 10 or more such children the board of education for that district shall establish such special classes as may be necessary for the education of these children. No class may contain more than 15 of such children. An important feature of the New Jersey law is the State aid which is accorded each district in the State which organizes one of these classes. The State authorizes an apportionment of $500 for each teacher employed in giving instruction to a class of children of this type. This State aid offers great encouragement to a community to organize such classes and enables a community to meet the expense of maintaining such classes without burdensome taxation. The commissioner of education for that State reported that, for the school year ending 31 July 1917, 162 classes had been organized. The establishment of these classes in New Jersey is compulsory. This appears to be the first State in the Union which has enacted a statute making it mandatory upon the local school authorities of an administrative unit to organize classes for children of this type. The training school for subnormals at Vineland, N. J., is one of the notable institutions of the country for this type of children.

The New York law enacted in 1917 is also a mandatory statute and is modeled somewhat after the New Jersey act. The commissioner of education is authorized to prescribe regulations to govern the taking of a census by the school authorities by each city and each school district. The local school authorities must take such census. The law further provides that each city and each union free school district shall establish such special classes as may be necessary to provide instruction adapted to the mental attainments of children who are three years or more below normal. This, of course, requires provision for all mentally

defective children as well as for the retarded children. No more than 15 pupils may be placed in one of these special classes. The school authorities of a city or district which has less than 10 children are required to provide for their instruction in another city or district which establishes classes or schools for such children. The financial aid given by the State is $300 for each class organized in a city or district.

The major work in a course of study for this type of children is industrial training. This type of child may be trained to become an efficient domestic worker and may be also trained to do very satisfactory work in agricultural lines. The institutions and the public schools which maintain courses for these children have demonstrated that large numbers of them may be trained to become self-supporting. To illustrate the type of course of instruction which is maintained for such children, I quote the following from the official report of the superintendent of the Rome Custodial Institution:

"Kindergarten; sense training; form, color, co-ordination and numbers; articulation and language; weaving; sewing, knitting and crocheting; sloyd; carpentry; painting; gardening; farming; domestic arts (dressmaking); music (vocal and instrumental); dancing; entertainment; Sunday School; chapel; farm colonies; domestic colonies; parole; discharge (or failure and permanent custody).

The institution located at Waverley, Mass., the one at Vineland, N. J., the Rome Custodial Institution, Rome, N. Y., and the State Normal School at Oswego, N. Y., maintain courses for the training of teachers for this type of school. Undoubtedly other institutions for this type of children also maintain such courses.

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EDUCATION IN THE HOUSEHOLD ARTS. See HOUSEHOLD ARTS, EDUCATION IN THE.

EDUCATION OF IMMIGRANTS. During the 14 years preceding the outbreak of the European War 11,726,606 immigrants over 14 years of age were admitted to the United States. Of this number 3,116,182 or about 25 per cent were illiterate. During a year of ordinary immigration preceding the war more than 1,000,000 immigrants came to this country. In the year 1914 the number was 1,218,480. Illiteracy has been on the increase in 18 States in the Union. These States are the leading industrial and mining States, and include New York, New Jersey, Massachusetts, Connecticut, Pennsylvania, Illinois and California. These are the States in which the great majority of immigrants settle. Under the first selective draft law 1,243,801 alien males registered who are between the ages of 21 and 30. Under the military ages fixed in the amended draft law, 18 to 45, there are 3,000,000 unnaturalized alien males in this country. About 20 per cent of these cannot speak English. When they enter the United States army they will be unable to understand the commands of their officers until they are taught to understand English. There are 5,500,000 people in the United States who are unable to speak English.

In the last decade there has been a large decrease in the number of illiterates under 14 years of age. Under compulsory attendance laws illiterates under this age have practically disappeared. The number of negro illiterates is rapidly decreasing. The number of native-born white illiterates is also rapidly decreasing. The only class of illiterate which has been increasing during recent years is the foreign-born. This large number of citizens unable to speak the language of the United States exceeds the number of soldiers which the government expects to send to Europe to fight in this war. The number equals about one-twentieth of the population of the country. These immigrants come to the United States for the purpose of obtaining larger opportunities for themselves and their children. They naturally drift to the sections of the cities which are inhabited by former residents of their native lands. Thus there are to be found in all the large American cities a particular section inhabited by Italians and known as the Italian section, another inhabited by Poles and known as the Polish section, etc. These immigrants do not get the spirit of the life of American or democratic institutions. They retain to a very large extent the customs and habits of the country from which they emigrated. It is difficult for them to learn to speak English and they are not able to communicate readily with Americans. This fact is to their disadvantage in obtaining employment. Then, too, they do not acquire so readily a knowledge of the laws of the United States, of their rights in and their obligations to the country. About one-third of the prisoners in penal institutions in the United States are aliens. The number during the decade preceding the war had constantly increased. They have in many instances been here but a short period of time and have committed minor offenses. They are in many cases the leaders in riots and in other movements of disorder and lawlessness.

President Wilson in addressing several thousand aliens made the following statement: "You cannot become thorough Americans if you think of yourselves in groups. America does not consist of groups. A man who thinks of himself as belonging to a particular national group in America has not yet become an American. . . . America was created to unite mankind by those passions which lift."

Immigration is a national affair and has always been regulated by the Congress. The action of the Congress in passing a measure over the veto of the President in 1917 prohibiting immigrants from coming to this country who are illiterate has simplified in a measure the question of adult illiteracy. While no additional illiterates will be admitted to this country there will still be large numbers of immigrants admitted who are not able to read or write English. In the problem therefore of immigrant education there are two types of alien who must have consideration. First, the illiterate alien, and second the literate alien who is unable to speak English. It is as important to educate the non-English-speaking literate alien as it is to educate the illiterate alien for preparation for citizenship, by informing him upon the fundamental features of the social,

industrial and civic questions upon which the progress and prosperity of a democracy depends.

This subject has never been approached as one of the great national problems which the country must solve. For many years various charitable, philanthropic, religious and civic organizations, in various parts of the country, have done very much toward the education of the illiterate alien. The North American Civic League for Immigrants, The Baron De Hirsch Fund, The Educational Alliance, The Young Men's Christian Association and many civic, religious and charitable societies have done much pioneer work of great value in this field of education. The great railroad corporations and many of the industrial and manufacturing corporations of the country have maintained schools at their own expense for the education of their alien employees. In many cases large corporations have found it to be a matter of economy to maintain such schools and therefore reduce the number of accidents, thus saving in industrial insurance and increasing the efficiency of the employees. The developments of this field of education are similar to the developments in all the new fields of education, which are ultimately assumed by the State. Charitable and religious societies usually take the initiative in such fields. Over half a century ago some of the American States, which had begun to realize the importance of this problem, because of the number of immigrants coming into such State, authorized the establishment of adult schools and of evening schools. The establishment of such schools was not mandatory but was wholly in the discretion of the community or its educational officers. This type of legislation has increased until most of the States having large numbers of aliens have authorized such schools. In most States attendance upon these schools is free. In some States small appropriations are made by the State but very generally the burden of the maintenance of such schools is placed upon the city or district.

The problem is not a local problem and local authorities should not be compelled to meet the expense of maintaining such schools. The problem is a National problem and a State problem. The National government should make appropriations which, supplemented by appropriations by the States, would be adequate to provide schools where all aliens might receive the degree and type of education which is essential for newcomers from other countries who intend to make America their adopted home. An effort has also been made to reach the alien through the organization of camp schools. In cases where cities and municipalities have been engaged in large constructive problems, notably in New York, in connection with the construction of the Barge Canal, the building of State roads and of the Ashokan Dam, where large numbers of aliens have been employed for long periods of time, temporary or camp schools have been established for the education of such aliens. The aliens employed in these labor camps do not remain in one place a sufficient period of time for the establishment of permanent schools. Experience in maintaining camp schools shows that if such schools are to be made effective there should be portable school buildings with equipment which may be moved from one place to another. The expense of maintaining these camp schools should be borne by the municipalities or the corporations or jointly by the agencies employing such aliens.

Massachusetts, New Jersey and New York have done pioneer work in alien education. Massachusetts enacted a law on the subject in 1887 requiring all illiterates between the ages of 14 and 21 to attend some school if they were continuous residents in the city or town where an evening school was held. An examination was prescribed to be given after the close of the instruction as a literacy test. In 1906 this test was that which was required in reading, writing and spelling for admission to the second grade in the public school. In 1907 for admission to the third grade and in 1909 to the fourth grade. The requirement now is admission to the fifth grade. The law prohibited the employment of a minor unable to pass this test unless he attended an evening school. The New Jersey law of 1907 provides that the board of education "may establish and maintain a public evening school or evening schools for the instruction of foreign-born residents of said district over 14 years of age in the English language in the form of government and the laws of this State and of the United States."

The most recent and comprehensive legislation on this subject is that of the State of New York. Three laws were enacted in 1918 by that State. One provides for the training of special teachers to instruct illiterate adults, under the supervision and direction of the State Education Department and an appropriation was made by the State for the purpose of holding summer institutes in which teachers so adapted to this work might receive instruction on the most natural and modern ways of approaching the foreigner and teaching him not only the English language but his relations and obligations to the government. Another of these laws makes it mandatory upon the cities and school districts to maintain night schools on three nights per week for two hours each night. In cities of the first class these schools must be maintained during the duration of the period that day schools are maintained. In cities of the second class such classes must be maintained for 100 nights. In cities of the third class they must be maintained for 80 nights. In school districts outside of cities and which have 20 or more persons above the age of 16 years who desire instruction, such school must be maintained for 75 nights. Attendance upon these night schools must be free. The purpose therefore of these two acts is to provide the necessary facilities for the maintenance of schools where illiterates may receive instruction and also to provide trained teachers who may give such instruction. The third law makes it obligatory upon certain minor illiterates to attend these schools. An illiterate minor who cannot speak, read and write the English language sufficient for admission to the sixth grade of the public school if he is in proper physical and mental condition must attend the evening school or a day school until such minor is able so to use the English language. Unless a minor satisfies these requirements of the law he may not be

employed in industry. Provisions, with suitable penalties for the failure thereof, run against such minor, his parents or guardian and an employer.

In the State of California a plan has been adopted intended to reach the immigrant women and through them the home. This plan involved the establishment of a Home Education Department under the direction of the State authorities. Through this plan visiting teachers go to the homes of all the immigrant women who are illiterate and who need instruction in modern home making and in the customs and practices of this country. If laws similar to the statutes in New York and California could be enacted in every State and the National government and each State would make appropriations upon an equitable basis illiteracy in America could be practically eliminated within the next decade.

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EDUCATION IN THE LAW. See COUNSELLOR AT LAW.

EDUCATION OF MENTAL DEFECTIVES. See EDUCATION OF FEEBLE-MINDED AND MENTAL DEFECTIVES.

EDUCATION IN MUSIC. See MUSIC, EDUCATION IN.

EDUCATION AND NATIONAL DEVELOPMENT. Education has been an important factor in influencing our national development, our institutions, ideals, habits, efficiency, and general mental attitude. It has in turn been influenced by those permanent factors that determine, in large part, the nature and progress of any civilization — the geographical, physical and racial factors — and the institutions resulting, particularly those of a political, economic, religious, and social character. It is the interaction of all these factors that accounts for the peculiar relation of our education to our national development.

Nations that have a national system of education, directly controlled by the central government, have the power to influence conspicuously the character of education so as to produce a definite type of national life. Many of the important nations of the past have, through state aid, established, encouraged, and controlled to a greater or less extent their educational institutions,— elementary, secondary, and especially higher. They have likewise fostered and protected libraries, art, literature, and science. Their purpose was to raise the tone of national life, to train leaders for service in church and state, and to teach men their duties to the state, to each other, and to themselves.

In the United States, however, from the founding of the colonies until the present time, education has not been in the hands of the central government. During the colonial period of our history each colony acted independently, in this matter, and when our Constitution was framed the States retained the power to regulate education. Moreover, during the colonial period and until the second quarter of the 19th century, with few exceptions, both colonies and States left the subject almost wholly in the power of the local units of government, of which the district was the most characteristic, or trusted to private or other agencies. This led to extreme variations in educational ideals, institutions, and practices, with the result that the direct influence of education on national, as distinguished from State or local life, was small. By this we mean there was little tendency to educate the individual in a way to prepare him for efficient citizenship, with an appreciation of his duties and obligations toward the nation. Indeed this was hardly possible until there was a realization that the local communities were to become parts of a great whole or until the national spirit was born. Since a political basis for national education was lacking schools were maintained largely for the moral and religious development of communities, and the preservation of learning for its own sake. After the State systems were formed there was some improvement, but educational policies and institutions were necessarily largely determined by local or sectional needs.

In spite of this diversity, it is true that gradually the spirit of American education, and to a considerable extent its forms, have tended toward uniformity, with a correspondingly greater influence on national development. This tendency is due to the action of much the same forces that led to the substitution of the principle of union and nationalism for particularism. In the case of education the process has been voluntary, without the compelling force of general laws issued by the central government. In other words the individual States have been guided by similar ideals and forms of education, because they best express the needs of their people. The more the various sections of the country became one in spirit and institutions, the more the State systems of education have tended to become similar in spirit, practice, and form.

Before the American Revolution two movements or forces prepared the way for a greater influence of education on national development. First, the tendency to recognize the responsibility of the state for education, rather than some other agency like the Church or agencies of a private character. This notion appeared first in 1647, in the legislation establishing the educational system of Massachusetts. Second, those forces tending toward the sentiment for and feeling of nationality, based on common political institutions and language, literature, habits of thought, aspirations, and especially on the influence of environment in producing democratic tendencies.

The American Revolution was the first great event which increased the influence of education on national development. It stimulated a desire for institutions which would express national rather than local needs, and placed emphasis on subjects expressing national rather than local sentiments. The Revolution hastened the decline of the Latin Grammar School, already an institution failing to meet the needs of the generation before the Revolution, and ushered in the Academy, a secondary institution, better suited to the needs of the people and more democratic in aim, type and distribution than was the Latin Grammar School. The Academy was the forerunner of the still more democratic institution of the next gen-

eration, the public High School. The Revolution also stimulated an interest in English, the mother tongue, which was the beginning of serious study of this subject. It stimulated patriotic sentiments which led to an interest in our national history and hence the study of history and civics, the foundation of political education.

With the formation of our first national government, the Congress of the Confederation passed the first act that emphasized the national aspect of education. This was the Grayson land ordinance of 1785, which provided for the reservation of lot number 16 of every township as surveyed, in the newly-acquired western territory, for the maintenance of public schools within the township. The ordinance for the government of the Northwest Territory, 13 July 1787, contained an important article, number three, which reads,—"Religion, morality, and knowledge being necessary for good government and the happiness of mankind, schools and the means of education shall forever be encouraged." On 23 and 27 July Congress not only provided for the sale of land to the Ohio Company and authorized the reservation of land, lot number 16, in each township, for schools, but also provided the two townships demanded by the company "for the support of a literary institution." The precedent thus established was followed, and in all territory later included in the public domain, reservations for elementary and higher education were made in a similar manner. Thus provision was made for the endowment of the State universities, a type of educational institution that has had great influence on national development.

Later the Congress of the national government granted additional tracts of land to the western States for educational purposes, culminating in the Morrill act of 1862. This act provided for large grants of land to each State to endow "at least one college where the leading objects shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the States may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions in life." The importance of this attitude of the Federal government toward education consists in the fact that it is an acknowledgment that the Federal government has a right and duty toward national education, notwithstanding the delegation of the power to the States. The educational institutions resulting from these acts have had great influence on our national development.

In the second quarter of the 19th century the forces engendered by the industrial revolution reacted on education. The rise of manufacturing, the factory system, the new grouping of population, and the humanitarian and democratic movements following, brought insistent demands for free elementary and secondary education at public expense. It is principally from this period, 1830 on, that education has had an increasing influence on national life. This relationship was further stimulated by improvements in intercommunication, by means of the steamboat and the railroad, and in agencies for the transfer of intelligence, the newspapers, libraries, telegraph and telephone.

The public school has been the chief instrument for influencing national life. The State systems of public instruction have as their basic idea, that it is the duty of the State to make education available and free for all, at public expense. Other principles gradually adopted include State support and administration, compulsory attendance and supervision, and fixed standards for the subject matter of the curriculum and for qualifications of teachers. The tendency toward uniformity in these matters has made it possible for public education to influence greatly national development. One important effect, for example, has been the secularization of public education, and hence a marked decrease in the religious element in the curriculum, and a decline in the influence of church supported schools. After the middle of the 19th century legislation prevented public funds, with few exceptions, from being used to promote sectarian education.

Public education has also reacted in a way to give a certain mental attitude to the nation. As America has been a synonym for opportunity, and freedom for the development of the human spirit, public education has absorbed this spirit and emphasized methods of instruction which encourage individual initiative and independence of thought. This attitude tends to perpetuate the spirit of democracy and opposition to autocratic political systems.

The development and extension of the notion of public democratic education has been most important in its influence on national life. The reasons for, and justification of, the principle are as follows: First, the basis of free institutions in any nation is the intelligence and integrity of its citizens. Our government in the last analysis is based on public opinion, and it is only through an enlightened public opinion that the permanency and success of the Republic are possible. The more universally the people are educated, the less need there is of restraint, and the greater is the check against corruption or unwise legislation by representatives.

Public education directly affects national development, because through this agency national interests are best promoted. With the extension of the suffrage and the tendency to place the government more and more on the hands of the people, or their directly elected representatives, both voters and leaders needed education to act intelligently. Again, public education promotes national well-being, because it leads to greater economic efficiency, and hence greater national wealth. It promotes industry because it awakens desires for more and better goods. It promotes discoveries and inventions. It leads to greater social efficiency because it reduces crime, and turns thought in the direction of social service. As patriotism is essential for the preservation of the nation, public schools become the principal means of teaching pupils their duties and obligations to the State, as well as their rights and liberties. Public education leads to more rapid progress, as civilization can advance permanently only as the mass advances. Public schools give opportunity to teach the masses to appreciate and desire the best in literature, art, and music. In

short national life as a whole could hardly be enriched to any great extent except through public education. Finally, education has as its chief aim the formation of character, and hence the national character can be best formed through the public school. It has for its aim the promotion of the educational and moral development of the masses — the ethical as well as the material aspects of life.

In spite of the many ways in which public education has influenced national development, it falls far short of what is possible. After all is said, the State systems of public instruction, in their origin, development and present conditions, tend to express very largely the local or sectional needs of the communities in which they are placed. The educational policies adopted are not primarily national in character, nor in harmony with each other. There is too much variation in types of educational institutions, emphasis or lack of emphasis on various kinds of education, and attention paid to the problems of national life. This nation, like others, was developed through conflicts, three in particular; the American Revolution, the Mexican War, and the Civil War. Each left prejudices which have been perpetuated in our educational system, the first against England, the second against Mexico and Latin America in general, and the third the antagonism between the North and the South, still perceptible in certain features of the education in the two sections. The first two prejudices interfere with our international relations and intercourse, causing a lack of sympathetic knowledge of the progress and problems of England and Latin America. These prejudices affect teaching of history in the public schools, as well as geography, and lead to provincialism from the standpoint of the relation of the United States to world conditions. The third prejudice affects particularly the teaching of history and tends to perpetuate the disintegrating force of the Civil War, because it interferes with national unity. All these difficulties are inherent in the State systems of public instruction, but could be remedied in large part through greater national control or by the placing of emphasis on problems of national life.

Another serious fault of our public system of education is its failure to give equal opportunity to all sections and classes. The more backward sections, or those less fortunate in their economic life, cannot give the same opportunities for education as the more advanced and wealthy sections. From the standpoint of the influence of education on national life this is unfortunate. To nationalize education in this respect, it is proposed that the national government should equalize these variations so that part of the wealth of the whole people will be available for those portions of the country not able to develop public education to the highest standard.

It is proposed that the national government should consider not only the matter of support but also that of control, at least so far as to establish minimum standards of education and teaching, and to develop the principles on which public education should be based. For to promote national in place of local, provincial, and sectional development and interests, the principles must be determined at one centre, and not at 48 centres. It is recognized that this will be even more necessary in the future, because of the revolution in the industrial and social systems of the country, and the great importance of national development and life in connection with the world interests and responsibilities of the nation. As the old notions of State rights have been overthrown in the economic and political world, and as the nation has taken over many of the early powers of the States in these respects in order to gain greater efficiency in national development, so it is proposed that the same policy should be pursued in the matter of education. For it is only through the resources of the whole nation that the expense of nationalizing education can be met, and only through national control can those principles and minimum standards be established which will best promote national interests.

A third weakness of the public school system under individual State control is the failure to hold a good proportion of the pupils for the full course in both elementary and secondary schools, and to train them efficiently. About two-thirds of the pupils, boys and girls, leave the public school before they reach the age of 14, and enter industrial, commercial, and agricultural pursuits poorly trained. Hardly 1 per cent of the 12 or more millions of persons engaged in agriculture have received adequate training for this pursuit. Much the same can be said of the 14 millions engaged in manufacturing and mechanical pursuits. Similarly the State systems make for great inequality in the teaching force. Of the 212,000 teachers for rural schools nearly one-third have an education in quality below the ninth grade, and another one-third not above the 10th grade. That is, 150,000 out of 212,000 rural teachers have inadequate preparation for teaching and the remaining one-third have only an average high school course with one or two years of normal school training. Here again it is only through greater national aid and control that we can secure the greatest influence of public education on national development.

Recent tendencies in American public education have tended to emphasize still further the close relationship of education and national life. There is more and more effort to make education richer and broader; to provide more opportunities for the masses for a complete education from the kindergarten through the university; to increase the number and variety of agencies and institutions for education and development, such as playgrounds, lectures, continuation schools, correspondence, evening, and summer schools; to use school plants as community centres; to extend the benefits of free education not only to all children but to all the people; to pass beyond the older conceptions of moral and book education, to new types; to emphasize physical education, involving not only physical training but free medical examination and care of health — in short, to develop the physical as completely and with as much care as the mental being; to give opportunity not only for general education but also for types that will fit for specific vocations, and to provide special teachers for vocational guidance in order to help pupils select the vocation for which they are best adapted. A demand for a special type of education, military educa-

tion, is due to the emergency brought on by the world war; but it is advocated by many as a necessary and permanent kind, in order to provide for national safety. It is evident that these tendencies are certain to have important effects on our national life. The effort to extend the control of the national government over education, through the proposal to create a department of education with a cabinet officer, is another plan to relate education still more closely to national life.

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EDUCATION IN PAINTING. See PAINTING, EDUCATION IN.

EDUCATION OF THE PHYSICALLY HANDICAPPED. For a long period of years, a child who was born deaf or blind or who did not possess the full normal use of any of the organs or members of the human body has been called a defective. It has also been the practice to classify children who have lost the use of any of the organs or members of the body through disease or other causes over which they have no responsibility as defective children. This classification is not regarded by those who have had the largest experience with these types of children as either wise or proper. A child who has not the full normal use of any of his organs or of any part of his body is generally sensitive about his condition and needs the sympathy of his fellows who have not suffered the loss and disadvantages that grow out of such physical conditions. If there is a psychological or other advantage in the terminology which may be used in speaking of children of these types, it seems wise and desirable to employ such terms in all references to or discussions of such children. It is not generous nor fair to these children to speak of them as defectives. The common meaning which such term conveys is too broad. Such term has a tendency to bring a degree of reproach upon such children which they do not merit. This is especially true when consideration is given to the general view which prevailed until within the last century and a half, in the civilized countries of the world, in respect to these children. One hundred and fifty years ago they were generally looked upon as children who did not possess the mental capacity for training or for citizenship, who were not generally capable of self-support and who must remain a burden upon society. The belief that the deaf and blind could not be educated was so universal that within the last century they were actually referred to as children of "silence," "solitude" and "darkness," "sorrow-stricken children of silence," "abandoned to his hard fate of wandering in darkness, the pitiable object of dismal despair."

The results achieved by extending to these children their inherent rights to an education and the standing which the deaf and the blind have attained for themselves in the general affairs of life, when given the same opportunities which have been afforded other children, have led to the adoption of an entirely different policy on the part of society and the state in relation to them. It is now universally recognized that these children are entitled to certain privileges as a matter of right which must be respected by the state and that there are certain definite obligations imposed upon the public which must be discharged. These children should not therefore be classified as defectives or wards of the state. The modern and the most appropriately just classification for these children is to designate them either as deaf children, blind children, or crippled children, or under the general term, physically handicapped children.

The most reliable information obtainable shows that there are in the United States approximately 46,000 deaf persons and 60,000 blind persons. More than 35 per cent of the deaf are born in that condition and about 75 per cent of the deaf become so before they reach legal school age, which is generally, in the American States, five years. Eighty per cent of the deaf children are not able to speak. Less than 2 per cent of the blind are born in that condition and about 12 per cent become blind before they reach the age of 20 years. Statistics show that these several classes of physically handicapped children are distributed through the several States fairly proportionate to the population thereof. The number is so large that it is necessary to provide a comprehensive, well-organized system of education adapted to their needs and conditions, if they are to be afforded the opportunities to prepare themselves for the responsibilities of citizenship which are at all comparable with the opportunities which are afforded the children of the country who labor under no physical handicap whatever.

There is not that uniformity of policy pursued in the several American States in relation to the education of these types of children that is pursued in relation to the education of normal children. There are two fundamental questions which have not been definitely settled in America in relation to the education of these physically handicapped children. These questions are: 1. What is the legal and moral obligation of the State in providing educational facilities for these types of children? Is the education of these children to be looked upon as a matter of charity or a matter of State obligation?

2. Are the facilities which shall be provided for these types of children to be institutional or as nearly like those provided for normal children as may be possible?

The schools first organized for these types of children were established largely through the efforts of men and women interested in such children either from the charitable or philanthropic standpoint. Men and women interested in the subject, persons of means with the philanthropic spirit, civic organizations desiring to promote social welfare and religious

organizations were the first promoters of institutions for the education of children of these types. In 1907 the State of Oklahoma incorporated into its constitution the following provision: "The legislature shall establish and maintain a system of free schools wherein all the children of the State may be educated." (Section 1, article 13).

The constitution of nearly every State in the Union contains a provision similar to that of the State of Oklahoma. This mandatory provision of the fundamental law of each State makes no discrimination between types of children. The provision is that these schools shall be maintained for the purpose of educating *all* the children and not simply the normal children. There should be therefore a settled policy on the part of every State in the Union to make suitable provision at State or community expense for the education of these children. Children who are so unfortunate as to be afflicted as these children are should be relieved to the same extent that normal children are relieved of the stigma of receiving their education as a matter of charity. The administration of public schools for normal children in every State in the Union is upon the basis that such schools are institutions of the State and must be supported and maintained by public taxation. The same principle should be applied in the maintenance of institutions in which children of these types are educated. The institutions which are maintained for the education of these children should be regarded in every way as educational institutions and they should not be classified nor grouped with charitable, reformatory, correctional or other institutions of this character which are maintained by the State.

The purpose in educating these children is to make them self-respecting, self-supporting and law-abiding citizens of the State. They are to be trained to assume their positions in organized society as other children are trained for that purpose. If this is the conception of the State in authorizing the maintenance of institutions for the purpose of educating these children then it is the obligation of the State to divest from such institutions every element which signifies that such institutions are a part of the charitable system of the State and that the persons educated therein are therefore objects of charity. To instill into their characters the element of independence essential to success in life the State must avoid the maintenance of institutions for their education which compel those who are trained therein to feel and believe that they are dependents.

There are many reasons why these types of children should be afforded educational facilities in the public schools of the city or district in which they reside whenever it is possible to do so. This is the modern trend in connection with the education of these children. Of course, this was not possible in the early history of the development of institutions for the education of these children, when such children were so sparsely distributed throughout the country. In large numbers of the cities of the country, there are now a sufficient number of children of each of these types to warrant provision for special classes in the regular public schools. It is not possible to provide for the establishment of such classes in the States which do not have large cities or in the territory of many of the States outside of their large cities. It will be necessary therefore to maintain institutions for the education of such of these children as live in these remote or more sparsely settled parts of the country. In about one-third of the States however there are public day-schools for children of these types. They have the advantage therefore of association with normal children and the personal consciousness that they are being educated for citizenship under the identical plan provided for the education of other children. The thought that these children are different from other children is thus largely avoided. An argument of great weight in favor of this mode of educating these children is that they are afforded the opportunity of remaining at home and therefore of having the influences and pleasures which home life provides. The feeling generally is somewhat repugnant to the idea of taking children at these tender ages, who possess such afflictions, from their relatives and homes and placing them among strangers in an institution. Such action must be avoided whenever it may be. It will also be more economical to provide for the education of these children in the regular public day-school than to pay for their education in institutions especially maintained therefor. The whole trend in modern school organization is in favor of this idea. The introduction into the schools of industrial education makes it possible to provide the facilities for the education of children of these types which are afforded in the special institutions.

The most advanced expression of public opinion upon this subject will be found in the law enacted in the State of New York in 1917. This law requires the board of education of each city and of each union free school district to take a census of all the physically handicapped children in such city or district. In those cities or districts in which there are 10 or more children of one of these types, the law makes it obligatory upon school boards to establish a special class and to provide instruction adapted to the mental attainments of the children and to their physical condition. This law also authorizes the school authorities of a city or district in which there are less than 10 children of one of these types to contract with the board of education of another city or district or with an established institution in the State for the education of such children.

Deaf Children.— There are recorded many early efforts on the part of individuals to teach some deaf friend or relative. The earliest record is probably that of a deaf person taught by Bishop John of York in 691. It is also recorded that Girolamo Cardona, a distinguished physician of Pavia, invented the first manual alphabet about the middle of the 16th century. The first organized class of deaf pupils to receive instruction, of which there is a record, was probably in the convent of San Salvador de Ona in Spain, and was taught by Pedro Ponce de Leon in 1550. It is claimed that his pupils became proficient students in arithmetic, Spanish, Latin, Greek and astrology. It was not however until about 1750 that the education of the deaf began to receive general attention in the countries of Europe. Schools had been established in England, Scotland, France, Ger-

many, Italy, Switzerland, Spain and Holland before the demand for their organization in America was created. In America as in Europe, the first effort was in an individual case when Philip Nelson of Rawley, Mass., was taught by Isaac Kilbourne in 1679. John Harrower, a teacher in Fredericksburg, Va., wrote in his diary that from 1773 to 1776 he had a deaf boy in his school. The real foundation of the education of the deaf in the United States was begun in the city of New York in 1810. John Stanford, a minister, had discovered several deaf children in the city almshouse. He readily recognized the need of these children and believed that they could be taught. He undertook to give them instruction. Interest in behalf of deaf children was growing and, in 1816, a census showed that there were 66 deaf children in the city of New York. Public meetings were held for the purpose of stimulating interest in these children and one of the meetings took place in Tammany Hall. Private funds were collected to aid in this work. The legislature authorized a charter for the New York Institution for the Instruction of the Deaf and Dumb in 1817 and in the following year the school was organized. The city of New York showed its special interest in this work by making an appropriation to support it and pledging the city to maintain a limited number of pupils. The city also provided rooms for carrying on the work without cost to the institution. In 1819 the legislature made a special appropriation to aid the school and later appropriated a per capita sum for the support of each pupil. It was the initial work of the Rev. John Stanford therefore which led to the establishment of this institution.

Previous to this, Americans, who possessed the means and who had deaf children, sent such children to England or Scotland to be educated. Two families had controlled the education of the deaf in these countries and had found it profitable employment. They were the Braidwood and the Watson families. One of the former, who had become involved in certain scandals, left Scotland and came to America in 1815 to organize an institution in this country for the education of the deaf. Various attempts were made by him to organize an institution in New York, Baltimore and different places in Virginia. However, he did not succeed.

The man who did the great pioneer work in America in the development of institutions for the education of the deaf was Thomas Hopkins Gallaudet (q.v.). He was a young minister in Hartford, Conn., and in that city lived a young deaf girl by the name of Alice Cogswell. Her father was a physician. Because of her family's standing and of her intelligence, many persons in that city had become interested in her. This interest led to a census of the community and more than 80 deaf children were discovered. It was estimated that there were 400 deaf children in New England and 2,000 in America. The knowledge of this condition led to an effort to organize an institution to provide for the education of these children. Gallaudet was sent to Europe to investigate the subject and when he returned he brought with him Laurent Clerc, a deaf teacher who had been employed in teaching the deaf in Paris. Upon his return Gallaudet undertook to raise the necessary funds for the organization of a school. The principal cities of the country were visited, including New York, Philadelphia, Albany, New Haven and Boston. The legislature of Connecticut authorized the organization of an institution in 1816 by granting a charter. That State also appropriated $5,000. This was probably the first appropriation in America of public funds for the education of deaf or other physically handicapped children. Twelve thousand dollars had been raised by subscription previous to the opening of the school at Hartford, on 15 April 1817, and soon after an additional $12,000 was raised by the same method. The institution soon obtained a national reputation. Gallaudet went to Washington in 1819 to interest Congress in the movement. He met Henry Clay and, through the influence of that Southern statesman, Congress appropriated 23,000 acres of public land. From this appropriation the institution realized the sum of $300,000. The school was particularly regarded as a New England institution. Massachusetts instituted the policy of sending its deaf children to this school to be educated. Each of the other New England States followed the example of Massachusetts. Georgia and South Carolina did likewise and many private pupils were sent to the school from different parts of the country. Within the next decade institutions were founded in New York, Pennsylvania, New Jersey and Kentucky. These were all organized as private institutions. In 1823 Kentucky established an institution which was the first State school for the deaf in the country and this may be regarded as the beginning of a change of policy in the education of the deaf. Congress gave aid to this institution. For many years the deaf children from the Southern States and from many of the Western States were sent to this institution to be educated. From this time on the State recognized its obligation in providing for the education of these children by the establishment of institutions as State institutions in nearly all the States of the Union. The schools thereafter established, except in Maryland, New England and some of the Eastern States, have been organized as State institutions.

Every State except Delaware, New Hampshire, Nevada and Wyoming maintain an institution for the education of the deaf. Because of their small population these States find it more economical to provide for the education of their deaf children in the institutions of other States. There are 65 State institutions in the United States. Forty-eight of these are owned by the States which have erected them. In Connecticut, Massachusetts, Vermont, New York, Pennsylvania and Maryland there are 17 institutions owned by private corporations but under the general supervision and inspection of the State. Many of these institutions have been endowed. Appropriations are made by the State for the construction of new buildings for these institutions and for repairs and improvements to their plants. A per capita allowance is also appropriated by the State to the institution for the maintenance of students.

When institutions were first organized by the States it was the policy to restrict the number of students who might attend to a certain number of indigent pupils from a political division. The number was gradually increased and

the language modified which classified them as indigent pupils. Finally no limitations were imposed but the right of any deaf child in the State to attend was clearly specified in the law and provision made for meeting the expense.

An examination of the census of the United States shows that the deaf are generally employed in the chief industries of the country known as trades and in about the same proportion as hearing people. The number of deaf employed in the occupations which are classed as manufacturing and mechanical are much greater in proportion than the number of hearing persons so employed, while the number employed in mercantile and commercial pursuits is much less. The percentage of the deaf who either own or give direction to the business in which they are employed is about the same proportion as the hearing people. There appears to be no discriminatory action on the part of the employer in employing the deaf. He is employed under the same conditions and at the same compensation that others are employed. About 80 per cent of the deaf are employed in gainful occupations and about 90 per cent are self-supporting. The character of the instruction which the deaf should receive therefore does not differ from the instruction essential to a well-trained normal child. The courses of instruction in reading, language, history, arithmetic and all book-work as well as courses in vocational work for children are suitably adapted to the needs of deaf children. The method of instruction must, of course, be different.

The sign language has been used in the instruction of the deaf since special schools have been organized for their education. This system is called the manual or sign method. There is also a method known as the oral method. Many teachers employ a combination of the two methods. The sign language has always been the chief vehicle through which the deaf express themselves. There is a great disadvantage in this method since the public is not generally able to use it or to interpret it. The deaf have therefore been unable to communicate readily with those with whom they must transact their business affairs. There have been advocates of another method from the very beginning almost of the period when instruction was provided for the deaf. Dr. John Bulwer of England wrote in 1648, 'Philocophus, or the Deaf and Dumb Man's Friend,' in which he describes a method of articulation and lip-reading for the deaf, and in 1669, Dr. William Holder published a work on the 'Elements of Speech.' In this work Dr. Holder advocated the teaching of the deaf by a process of articulation. At this early date the foundation of the two rival methods of the present day for the instruction of the deaf was established.

Samuel Heinicke opened a school in Hamburg in 1754 and in 1778 on invitation of the government he removed the school to Leipzig. The State supported the school and this appears to be the first public school for the deaf. He was one of the great deaf teachers, was an advocate of the oral method and influenced the method of teaching the deaf in European countries and in America. Charles Michel, Abbe de l'Epée, was the founder of the first school in Paris which he organized in 1755. He probably exerted a greater influence on the instruction of the deaf in America than any other teacher.

The New York institution is said to have been organized as a day school in protest against the alphabet method of instruction and to have been conducted as a school using the oral method for 11 years. In 1869 the Boston Horace Mann school was organized as a day school and since that time day schools for the deaf have been established in 14 States. Such schools have been organized extensively in Wisconsin and Michigan. In the former State such schools have been organized in 24 cities or villages with an enrolment ranging from 5 to 146. In the latter State schools have been established in 14 cities or villages. The large cities are organizing such schools and they will be found in New York, Chicago, Cleveland, San Francisco, Los Angeles, Saint Louis, Saint Paul, Newark, Atlanta, New Orleans and others.

About 72 per cent of all the deaf pupils are taught the combination method, 26 per cent the oral method and 2 per cent the manual or alphabet method. About 83 per cent of all the deaf children under instruction or about 12,000 are in attendance upon institutions, about 14 per cent of these children or 2,000 are in attendance upon day schools and about 4 per cent or 600 in private schools.

High school courses for deaf students are generally provided. Gallaudet College, an institution for the deaf and named in honor of the American champion of the rights of the deaf, was organized in Washington in 1864 and is supported by the national government. See also DEAF; DEAF, EDUCATION OF THE; DEAF-BLIND.

Blind Children.— The efforts to develop a system of education for the blind have paralleled in many ways the efforts to develop a system of education for the deaf. For centuries the blind were regarded as objects of pity and as unfortunate beings. There is authority for the statement that a hospital for the blind was established by Saint Basil at Cæsarea in the 4th century and that a refuge for the blind was established in Syria in the 5th century. There is no record of consideration of any importance having been given to this type of unfortunate beings from the 7th century until the middle of the 13th century. It is recorded that King Louis IX of France established an institution for the blind about 1260. There are numerous records of individual efforts to teach the blind to read in the early centuries. These records show activities in Italy, Austria, Switzerland, France, England and Germany. It was not, however, until the close of the 18th century that success was attained in efforts to establish schools to be devoted to the teaching and training of the blind.

The one pioneer in this great work, to whom the blind are indebted most for the laying of a foundation for a system of education which has resulted in training thousands of blind people to become self-supporting and to get pleasure out of life, is Valentin Haüy, a Frenchman, who was born in Picardy in 1745. M. Haüy became interested in a blind boy by the name of François Lesueur. He had been much interested in the blind because of various experiences which he had with them. He had even made an investigation as to the methods employed by other persons who had attempted

to teach the blind. M. Haüy is the inventor of the first system of embossed printing for the blind. It was through an experience with the boy, Lesueur, who was employed in his office, that led to the invention of this system. When engaged in sorting papers on M. Haüy's desk, the boy obtained a card which had been deeply indented by type. The boy was able to trace out several of the letters on this card with his finger and was, of course, greatly delighted to show his master what he had discovered. M. Haüy then made several experiments with the boy and in this way obtained the idea of devising a system of training for the blind. He submitted to the Academy of Science at Paris in 1785 a plan outlining his method of giving instruction to the blind. A committee was appointed by that body to examine into the matter, and, after making due investigation, they gave M. Haüy credit for inventing the relief printing for the blind. In submitting its report, the committee stated:

"We propose to the academy to give its approbation to the method which M. Haüy has presented to it and to exhort him to make it public and to assure him that it will willingly receive any account that he may give of his efforts to carry it to the degree of perfection of which he is susceptible."

He undoubtedly established the first school in the world for the education of the blind. This school was known as L'Institution Nationale des Jeunes Aveugles and was established in France in 1784. In 1791 this institution, due to the Napoleonic wars, was discontinued and was not again opened until 1815. Doctor Guillie was then made the head of this institution. Industrial education was the basis of instruction given in this early school and it was continued under a larger and more practical plan by Dr. Guillie. He obtained much new equipment for the institution. The principal handicrafts which were taught in this school were spinning, weaving, sewing, knitting, chair caning, rope making, shoe making, harness making, etc. When the institution was closed under Napoleon's rule M. Haüy accepted an invitation from Tsar Alexander I to go to Saint Petersburg for the purpose of organizing an institution for the blind in that city. On his journey to Saint Petersburg, he spent some months at Berlin. King Frederick William III became interested in the blind and through the work of M. Haüy the foundation for an institution was laid. He spent 11 years in Russia but did not succeed in establishing an institution.

Soon after the efforts of M. Haüy to establish an institution for the blind in France, Edward Rushton began the education of the blind in England. J. Christie, a blind man in Liverpool, and a clergyman by the name of Dannett co-operated with him. Subscriptions were obtained for the enterprise and a school for the indigent blind was organized in Liverpool in 1791. The organization of this school created great interest in the blind people in England, and another school was organized at Bristol in 1793, and at London in 1799. Schools followed in Edinburgh, Scotland and Dublin, Ireland. At the beginning of the 19th century Herr Johann Wilhelm Klein became greatly interested in the blind children of Austria. He had observed many pitiable cases of the unfortunate blind children of that country. He received much encouragement, as did M. Haüy of Paris, from Maria Theresia Von Paradis, a blind Austrian singer, who had inspired these men in the belief that through a system of education the blind could be relieved of much of their misery and raised to a high degree of cultural standing. It was through the influence of these men and the schools which they established that institutions for the education of the blind were established throughout the countries of Europe between 1790 and 1810.

Maria Theresia Von Paradis had an important part in developing interest in this subject. She came from an influential family. She possessed musical talent which her parents recognized and provided the best teachers obtainable for her. An interesting plan was devised in teaching her to read. Pins were placed in a cushion so as to form the several letters of the alphabet. By placing her fingers on the pin heads constituting these forms, she was able to recognize the different letters and learn to read. Later similar letters were formed by making perforations in stout paper with a pin. She was able to determine the letters from the raised rough edges of the paper which these perforations made. Later a special press was made for her and with this she was able to print German characters in relief. As a child she was an efficient organist and became a notable singer in church choirs at an early age. The Empress Maria Theresa became attached to this young blind girl and provided a pension sufficient for her maintenance. As early as 1784 she traveled through Europe and captivated the whole world through the great musical talent which she exhibited.

Another blind person of an earlier period even than this blind girl, who aroused great interest in the need of educating blind children, was Nicholas Saunderson. He was an Englishman, born in Yorkshire in 1682. He became totally blind at the age of two. He attended a regular public school with seeing children and acquired a fine classical education. He later met distinguished teachers and through them became much interested in mathematics. He invented the abacus. He used this in determining mathematical problems. He later became a professor of mathematics at Cambridge. Other distinguished blind persons who exerted a powerful influence in developing interest in the education of the blind were Milton, the Scottish preacher Blacklock, and the engineer John Metcalf.

Schools were well organized throughout Europe before America gave this question much consideration. There were three schools in this country where the pioneer work in the education of the blind took place. The first school in America opened for the education of blind children was the New York Institution for the Blind. This institution was chartered by the State legislature in 1831 and has been in continuous operation since that date. A group of citizens in New York recognized the need of providing educational facilities for blind children. The founders of the school desired to provide facilities for the children whose parents were unable to pay for their education and at the same time to receive students whose parents were able to pay for their instruction. The school was started as a charitable institution. Its doors were opened 15 March 1832 with only three blind children. Soon after two other children were admitted. The prime

movers in the foundation of this school were Dr. Samuel Akerly and Samuel Wood, a well-known philanthropist. Dr. John D. Ross had discovered several blind children in the almshouse of the city and he was taking measures to organize a school when he learned of the work which the other two men had already done in this direction. He co-operated with them and was chosen as the head of this primitive school for the blind in America.

Dr. John D. Fisher of Boston was pursuing medical studies in Paris and he frequently visited L'Institution Nationale which had been organized by M. Haüy. He became interested in the subject and was desirous of establishing a similar school for the benefit of blind children in America. He returned to Boston in 1826 and began to urge the plan upon his friends. A meeting of those interested in the subject was held in 1829. A committee was appointed by this meeting which applied to the legislature of Massachusetts for a charter for an institution to be called the New England Asylum for the Blind. This charter was granted 2 March 1829. It appears, however, that no action was taken toward the organization of the school until 1831. Dr. Samuel G. Howe was then elected superintendent. He was sent abroad to familiarize himself with methods of instruction. He returned in 1832 and opened a school at South Boston with a class of six children. The school in New York had been opened a few months before the one in Boston was opened by Dr. Howe. In 1833 the Pennsylvania Institution for the Instruction of the Blind was established in Philadelphia. These institutions were organized by contributions from private sources but have for years received appropriations from the State.

In 1830 the United States government took its first census of the blind. This census showed that there were 5,444 blind persons in the country. The superintendent of the blind schools at New York, Boston and Philadelphia took groups of their pupils to different parts of the country to demonstrate to the people the feasibility of educating the blind. These tours created a profound impression upon the people all over the country and developed a sentiment which resulted in the establishment of other institutions. In 1837 an institution for the blind was established in the State of Ohio. This was the first school organized purely as a State institution. Other States followed in the establishment of such institutions until at the present time there are about 50 State institutions attended by more than 5,000 blind children. The last Federal census shows that there are about 60,000 blind people in the United States and that 10 per cent of these are of school age. In nine of the States provision is made for the education of the blind children who are under school age. The best modern thought is that children who are born blind should be placed under instruction at the earliest moment possible and that all children who become blind before they reach school age should also be placed under instruction as early as possible. The institutions for the blind are generally under the control of local honorary boards of trustees. This board selects the superintendent or principal of the institution. The institutions generally are subject to inspection by the State educational authorities.

Great interest has been manifested all over the country in the education of the blind within the last 20 years. The modern trend of thought is to provide for the education of blind children in the public school system. The first city in this country to try this experiment was Chicago. In 1900 that city organized a special class for the blind in one of its public schools. The experiment was a success. Additional classes were organized in that city and soon thereafter other cities began to incorporate into their school systems special classes for the blind. Such classes are now maintained in the schools of Cincinnati, Milwaukee, New York, Racine, Newark, Jersey City and many others. Chicago has three schools located in different parts of the city so as to make them the most accessible possible to all the blind children in the city. In New York city special classes have been organized in 12 of the different public schools of that city. When a blind pupil enters a special class in a public school he is assigned to a special room with a special teacher. The number of pupils in a class varies from 5 to 15. In this special class the pupils are taught to read and write in American Braille. When the child becomes able to read and write, he takes his place in the regular school classes and recites with the seeing children. He takes his turn in reading, writing, and in reciting in other subjects. After the recitation is concluded, the blind child goes to a special room to prepare his lessons under the direction of a special teacher. The theory is to arrange the work of the blind child so that he will continually spend more and more time with the seeing children.

The course of study for the blind is quite similar to the regular courses of the public schools. The tendency is to start the blind child in the kindergarten. The blind children who have kindergarten training make better progress in their work than those who have not had it. The course includes reading, writing, numbers, history, geography, physiology, nature study, etc. Physical training and music are two vital features of every well-regulated course of study for the blind. The setting-up exercises, the usual games for children in the classroom and on the playground, folk dancing, skating, rope jumping, and all the usual games and sports for seeing children are adaptable to the blind children. These physical exercises are essential to their proper physical development and to their health. They also aid materially in developing independence, comradeship, and community interest in the blind child. The courses of study extend through the elementary school and the high school. Eighteen blind children who completed the course of instruction in the elementary schools in New York city in the school year ending 1 July 1916 entered the high schools of that city in September of that year. These children are now trained for more extended service than in former years. In addition to the manual occupations, they are now trained for business positions, for teachers, for salesmen, typewriters, and several have taken up the profession of osteopathy. Many of them become fine musicians, organists, piano tuners, etc. That the blind have the capacity to obtain leadership is demonstrated by Huber, the naturalist; Prescott, the historian; Rodenbach, the Belgian statesman; Fawcett, the English statesman; and Gore, United States senator from Oklahoma. The names of Dr. Howe, Dr. Moon,

and Dr. Wait will always be associated in America with the development of methods for teaching blind children. They did a great work in this field of education.

The line alphabets which were used for many years in giving instruction to the blind have been abandoned. The point systems have come into general use. These are known as "braille." The base is a cell of six points. The characters used are made by various combinations of these six points; 62 characters are used. These characters each represent a letter, a mark of punctuation or a contraction standing for several letters. The system is named after its author, Lewis Braille, who devised it in 1825. There has been a long controversy between teachers of the blind as to whether the braille system or certain modifications devised by American teachers is the better. There appears to be no great fundamental difference in these systems. The American modification of the system differs from the other simply in the assignment of the letters to the various combinations. The American idea was that such letters as E, O, R, S, T, which occur most frequently in words, should be made with the fewest dots. One of the most noted teachers of the blind states that the New York point differs from braille by its characters being two points high and three wide instead of three points high and two wide. This author states that while the New York point system has many advantages, it has many disadvantages.

Most attention in the education of the blind has been given to the education of blind children. Although the great majority of the blind become so after reaching 20 years of age, there has been an apparent neglect in the education of the adult blind. Various organizations have been formed in recent years which are giving the needs of the adult blind special attention. State commissions have been organized by legislative authority in certain States supported by State funds, to provide for the education of the adult blind. In some instances, as in New York, the commission makes provision for home teachers. Under this method a teacher goes from home to home and gives instruction to the blind adult in his home.

A potent factor in the education of the blind adult is the work done through libraries. In March 1896 a library section for the blind was incorporated in the New York State Library. In the same year the Detroit Public Library selected 110 volumes and made these available for the blind of the city. The Library of Congress at Washington established a reading-room for the blind in 1879. There are now (1918) about 70 libraries maintaining divisions which contain embossed type books which are circulated among the blind people.

Crippled Children.—It was not regarded necessary to provide separate schools for crippled children until many years after schools had been founded for the other types of physically handicapped children. In recent years the number of crippled children has increased, owing to the prevalence of tuberculosis and infantile paralysis and to other causes.

In 1832 Bavaria established at Munich the first institution in the world for the education of crippled children. Up until 1890 only five institutions had been established in the United States. Three of these were in New York city and two in Philadelphia. Since 1890, 31 institutions for the education of crippled children have been established in this country.

Children's hospitals and orthopedic institutions have been organized from private contributions for the treatment of crippled children. In many of these institutions, provision has been made for their instruction during the period of time they have been under treatment therein. In Massachusetts, New York, Nebraska and Minnesota State hospitals have been established, and graded schools maintained by the State in connection with such institutions. However the means afforded for the education of this type of unfortunate children are not adequate to provide for the treatment and the education of the crippled children of the country. There is a large class of these children whose parents cannot afford to meet the expense of their maintenance in private institutions, and whose education is being neglected. Many crippled children who are physically able have always attended the public schools. A crippled child, possessing his mental faculties and being physically able to attend school, will make better progress by associating with normal children than by attending a special institution. In many of the large cities of the country, special schools are maintained by the municipality and in some cases in co-operation with contributed funds, for the education of this type of children. In other cities, the public school authorities set apart rooms in the public school buildings for the purpose of providing educational facilities for these crippled children. Each city and school district in the State of New York in which there are 10 or more crippled children is obligated, under the law of 1917, to establish a special class and to provide instruction adapted to the mental attainments of the children and to their physical condition. In a city or district in which there are less than 10 of these children, the school authorities are authorized to contract with the board of education of another city or district, or with an established institution in the State, for the education of such children.

The cities of Chicago, Cleveland, Boston and New York maintain day school buildings which have been designed, constructed and equipped with special reference to the needs and comforts of crippled children. These buildings are not all of the same type, but in them will be found such conveniences as inclines and elevators instead of stairways, movable chairs instead of desks, rubber or cork floors and handrails at low levels. Special chairs and seats accommodated to the physical defects of the children, couches, air cushions, folding chairs, blankets, sweaters, etc., are also provided. The Crippled Children's East Side Free School of New York city accommodates 200 and is the largest institution of the kind in the country.

Provision must be made for taking these children from their homes to the schools and for returning them to their homes. They cannot, of course, return home at the noon hour and it is necessary, therefore, to provide luncheon for them. The transportation and the luncheon are items of additional expense to the maintenance of these schools. In most cities the children are taken to and from the schools which they attend in large omnibuses drawn by horses. The tendency now is to change to the auto-bus. The seats in the buses used for this purpose are

constructed to meet the physical defects of the children. Attendants accompany all buses to see that the children are properly taken in and out of the buses, the school buildings and their homes and that they have safe transportation.

In the larger cities, where rooms in the public school buildings are set apart for these children, an orthopedic surgeon or a nurse is provided to give such special treatment to the children as may be needed. The city of New York maintains 60 schools or classes for the crippled children of that municipality.

Those children who are suffering from bone tuberculosis should be segregated from the other children and provision should be made for their maintenance, if possible, in a separate building. Open-air schools should be established for all children of this type.

All these different agencies for the education of the crippled children still fail to provide facilities for some of these unfortunate children. There are many children who are so badly crippled that they are prevented from attending institutions or schools even with all the comforts and conveniences which are provided for them. The only way by which such children may be instructed is through a teacher who visits them at home. To meet the needs of these children it is proposed in New York city, through funds provided by the Association of Public School Teachers, to employ visiting teachers who will go among the homes of the children and given them instruction.

Through private funds provision is made by some of the organized institutions for the care and education of crippled children whereby such children are given an opportunity to spend a few weeks in the country. Summer homes have been established for this purpose by some of these institutions in New York, Baltimore and other cities.

The work in these special classes for crippled children is based upon that of the regular elementary school work of the city in which the classes are organized. This work includes a large amount of handwork such as basketry, weaving, sewing, etc. Only in exceptional cases is there an effort made to carry the pupils beyond the elementary grades.

This movement of recent years to provide special classes in the public schools and home teachers for those unable to go to school, thus making an elementary education accessible for all the physically handicapped children of the country and at the same time affording them the associations and influences of home life, is a manifestation of the broad, humane, democratic spirit of the philosophy upon which American public education is founded.

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EDUCATION OF TEACHERS. See TEACHERS, PROFESSIONAL TRAINING OF.

EDUCATION IN THE UNITED STATES. Every nation has its social ideals and believes in the maintenance of those ideals. Education is the instrument by means of which a nation hopes to realize its ideals. Because different nations have different ideals, there exist different systems of education. In Europe the ideals are the resultants of historic forces. Society has developed in strata and the classes in control of the destinies of the various nations believe in the maintenance of these strata. As an individual is born into a class of society his education is organized chiefly to fit him for the various vocations of that class. This conception of education has been successfully maintained not only because of the organization of society into castes, but because of the relative stability of the population. Most people live in the community in which their parents lived and it is natural for their children to take up the vocation of their parents. These two factors explain to a great extent the remarkable success of the industrial education movement in Germany. Neither difference in political ideals nor in the age of a national system of education seems to affect this attitude toward education. Prussia with its autocratic conception of government and its century-old system of education, is but little more representative of this type of education than is England which is organized politically as a democracy and which developed a national system of education but a generation ago.

Theory of Education in the United States. — The theory upon which education is organized in the United States is the very opposite of that which holds in Europe. There are as yet no castes here and few parents are content to have their children continue in the "station" in life in which they were born. For the first time in history there is an attempt made to realize the educational ideal portrayed by Plato in his 'Republic,' viz: That every individual should be doing that in life for which he is best fitted; that education should be so organized as to discover for what the individual is best fitted, and then to provide him with the proper and necessary training. This is done, it must be admitted, crudely and haltingly, but the American democracy is practically the only great state in which there exists an educational ladder reaching from the kindergarten to the university, in which all parts, elementary, secondary and higher, are so articulated that an individual may freely pass from one to the other. In the European systems of education only elementary education is free and it does not articulate with secondary education. The elementary school carries the child to 12 or 14, giving him a rounded elementary education. The secondary school begins at nine and commences to teach subjects not considered in the elementary school, such as mathematics and foreign languages. Even should a child of the masses when he completes the elementary school, then have the ambition and money to continue his education, he would be unprepared to enter the secondary school. There is nothing for him to do but to enter one of the vocational schools for training in some trade or industry. And that is what is expected of him. The American democracy is by no means perfect in all its aspects; but as far as education can accomplish it, it aims to give every individual the opportunity to make the most of his native abilities and to assume the place in society which his abilities justify. This was not always so, and to understand the American system of education as it exists to-day it is necessary to make a brief survey of its development since colonial times.

THE COLONIAL PERIOD.

History of Education in the United States. — The Reformation principle that the individual should be guided in life by the Bible had as an educational corollary that he should at least be taught to read it. Where the Reformation was chiefly a religious movement and was carried to logical conclusions, the effect upon the development of universal education was quite direct, but where the Reformation was political and ecclesiastical rather than religious, and halting rather than thorough, the attitude toward education was one of comparative indifference and neglect. The former condition was true wherever Calvinism prevailed, as in the Netherlands, Scotland and among the Puritans in England. The latter condition was true in England generally, where the Anglican Church was in the nature of a compromise. The United States was settled in the 17th century when religious antagonisms were most bitter and, moreover, it was largely settled by groups of people who fled from Europe because of religious persecution and because of their desire to worship in their own peculiar way. The kind of educational system that would be established in any part of the new land would be determined chiefly by the kind of religious opinions held by the people settling there. We find three fairly distinct types of education developing in the colonies:

1. The Selective Type prevailed in the southern colonies where distinctions of classes developed and the Anglican Church was established. The gentry employed tutors for their own children or sent them to England to be educated. They were not only not interested in the education of the masses who were in many instances indentured servants and convicts, but believed solely in the system of apprenticeship as a preparation for the trades which were to be the life-work of these lower classes. Hence, down to the Revolution, the character that was early impressed upon education in the southern colonies remained, i.e. fair provision for secondary education through the voluntary and haphazard establishment of Latin schools, and little provision for elementary instruction beyond the system of apprenticeship.

2. The Parochical School Type prevailed in the middle colonies. These colonies were settled chiefly by various Calvinistic sects like the Dutch Reformed in New York and the Presbyterians in New Jersey, or by other sets of the advanced Protestant type, like the Quakers and Mennonites of Pennsylvania. They all believed in the need of everyone to read the Bible, and all, therefore, favored elementary education. But as each sect denied the efficiency of any other's way to salvation, this elementary education took the form of parish schools attached to the church. In all the middle colonies in addition to the parochial schools for elementary education there existed "grammar" schools for secondary education.

3. The Town School Type prevailed in New England. The people who settled there were more homogeneous than in any other part of the country. There was little distinction of classes among them as in the southern colonies and there was no distinction of sects as in the middle colonies. They were mostly of the middle class socially, were generally well educated and had university graduates for leaders; were thorough believers in democratic government and were strong upholders of the Calvinistic-Genevan principle of the church-state form of government. Holding firmly to the necessity of everyone being able to read the Bible, the General Court, i.e., the legislature of Massachusetts, passed the famous law of 1647 by which "the Puritan government of Massachusetts rendered probably its greatest service to the future." The law provided that every town that contained 50 families should maintain an elementary school and a town that had 100 families should maintain in addition a "grammar" school to fit the youth for the university. The religious motive that prompted the law is stated in the preamble, namely, to prevent "that old deluder, Satan, keeping man from a knowledge of the Scriptures." Unfortunately, subsequent developments resulted in the decline of education in New England and the decay of the town school. The chief cause was the spread of population into unsettled regions and the attainment of local government by districts within the town. The houses of the early settlers were clustered around the meeting house of the town, partly for better protection against Indians and partly because of religious devotion. As religious fervor decreased in the 18th century and fear of the Indians passed away with their diminution in numbers, settlers moved into parts of the town that were inaccessible to the town school or they moved into entirely new regions that had no town school. Hence arose the "district" school, which could afford only a poor teacher who "kept" school a few months in the year. In all the colonies the colleges that had been founded, such as Harvard and Yale in New England, Columbia, Princeton and Pennsylvania in the middle colonies and the College of William and Mary in Virginia, supplied the higher education needed by the members of the learned professions.

THE PERIOD OF TRANSITION.

The Revolution had both a bad and a good effect upon education. The war bankrupted not only the central government, but many of the state governments. The British fleet had destroyed colonial commerce; its blockade had brought industry to a standstill and thousands were reduced to poverty. In hard times education is generally one of the human activities that is first to suffer. Moreover, other obstacles to the development of a national system of free schools existed. (1) One was the practice of granting public moneys to private schools. This practice was general throughout the colonies but can be best illustrated in connection with the academy movement. The decadence of the town school and of the Latin grammar school in New England due to the growth of the district school was much hastened by the poverty resulting from the Revolution. But the well-to-do classes would not let their children go without secondary instruction and the policy was inaugurated of establishing private secondary schools called academies. Though these academies were private corporations, through the influence of their supporters they were usually able to secure subsidies of public moneys either from the State government or the towns. They performed a splendid service, for they

were generally well organized and administered, were responsive to the needs of their constituents and introduced modern subjects like English literature and science. But they were pay schools and hence not open to the children of the masses; they withdrew the attention of the influential people from public education, just when it was most needed; and they created vested interests which were often opposed to public interests. When one considers that by 1840 Massachusetts alone had 50 such private academies subsidized with public funds and that the movement had spread throughout the country, one can realize the extent to which they were a hindrance to the growth of public secondary schools. (2) A second obstacle to the development of a system of free public schools was the existence of sectarian religious jealousy. Nearly all the sects opposed a movement which would prevent the teaching of their own peculiar form of religion and which would also render valueless the school property which they had accumulated. (3) A third obstacle was the prevalence of the idea of public education as pauper education. The idea that free schools were only for the poor prevailed generally throughout the country south of New England. (4) Another obstacle was the claim that the public school was based upon an undemocratic principle, that it was unjust to compel people without children to pay for a service from which they received no benefit, or to compel parents who sent their children to private schools to pay for the education of other people's children. This view explains the "permissive" legislation of the early decades of the 19th century by which local areas were permitted to decide how much support they would give to public schools. For example, in 1831 an act was passed by the legislature of Indiana which permitted the voters of school districts into which the counties were divided to decide the amount of local tax to be levied for the support of public schools. But the act contained the proviso "no person should be liable for taxation who does not or does not wish to participate in the benefits of the school fund."

But if there existed numerous obstacles to the development of a system of free public education, there developed counter movements stimulating its development. (1) The principles of liberty and equality for which the Revolution was fought combined with the growth of a new political and social order to develop a belief in the need of universal education to realize those principles and that order. With the opening up of the West there developed a condition of society in which social influence, religious affiliation and wealth counted for much less than in the East. (2) Moreover, the Federal government, even before the adoption of the Constitution, adopted a policy the influence of which in the development of American education cannot be overestimated. The northern territory which had been ceded to the Federal government by the various States claiming parts of it and from which the States of Ohio, Indiana, Illinois, Michigan and Wisconsin were carved, was organized under the famous Ordinance of 1787. In accordance with the provisions of that act the entire territory was divided into townships six miles square, and of the 36 sections into which each town was subdivided, section 16 was reserved for the support of public schools. Moreover, two whole townships were reserved for the support of a State university. This admirable policy was continued in all the territory secured by the United States through purchase or conquest. (3) The introduction from England of Lancaster's system of monitorial teaching whereby one teacher with the assistance of older pupils (monitors) could instruct hundreds of children was one of the greatest stimuli to the establishment of public school systems, because its cheapness was influential in securing appropriations from legislatures for the establishment of public schools. (4) The infant school movement and the Sunday school movement were also steps in the direction of accustoming people to think of education for all. Though, as the result of the interplay of these opposing influences, education was everywhere becoming less aristocratic and sectarian and more democratic and secular, the advent of a public school system came only as the result of a great awakening.

THE PUBLIC SCHOOL REVIVAL.

Massachusetts established its State Board of Education in 1837 and Horace Mann, with whose name the public school revival is inseparably associated, was made its first secretary. As a result of his 12 years of service in that position and by means of his annual reports, his *Common School Journal* and his speaking tours throughout the State, he was able to secure reforms in the public school system of Massachusetts which were little less than amazing in their extent and value. These included the establishment of normal schools for the proper training of teachers, the extension of the school year by a month, the gradual substitution of the public high school for the private academy, the doubling of appropriations for public education, the increase in pay for the teachers by more than 50 per cent and the adoption of new agencies for improving the efficiency of instruction such as teachers' institutes and school libraries. These admirable reforms were not secured without bitter opposition from conservative schoolmasters and sectarian religious interests. But the movement spread to other States and under the leadership of Henry Barnard of Connecticut, David Page of New York, and a number of enthusiastic educators in the Middle West, by the close of Reconstruction it had resulted in all the States of the North organizing a public educational system providing free elementary and secondary education and in many States higher education also. In the South, the principle upon which the movement was based was adopted but its realization was delayed by the deplorable conditions resulting from the Civil War.

A National System of Education.— The period since Reconstruction has been one of educational expansion. In the newer western States sectarian jealousy and the conception of free public education as fit only for those who could not pay tuition fees never appeared and the first constitution of each of those States provided for a complete system of free education extending from the elementary school to and including the university. Everywhere the principle

of unification and centralization won out. This victory for centralized State control was due to a great many causes, but chief among them were the following: (1) The appropriation by the Federal government of millions of acres of land directly to the State for the support of elementary schools and of higher institutions for agricultural and technical education. (2) The distribution of State moneys by the State educational department to the local geographical areas, provided the latter would meet requirements laid down by the former. (3) The unifying and standardizing influence of the State university into whose hands the control of secondary education has in some States been placed. (4) The growing faith of the American people in public education to solve the political, social and economic problems which confront them and hence the necessity that it should be centralized in order to be efficient.

In a Federal state like the United States, each State has exclusive control of its educational affairs and the question naturally arises whether there exists in the United States a national system of education. The Federal Constitution adopted in 1789 makes no mention of education, that being one of the governmental activities reserved to the States. But the policy of the central government ever since its organization has been to assist the extension and development of education in every way possible. It has done this in two chief ways. (1) By means of gifts of land to the several States for educational purposes. This has amounted to 81,064,000 acres with an original value of $103,000,000 for elementary schools alone and 14,775,475 acres for higher education. In addition to this munificent gift the National government by act of Congress in 1887 provided for a perpetual appropriation of $15,000 a year for each agricultural experiment station connected with a State agricultural college and by the Act of 1890 appropriated $25,000 a year to each of the colleges themselves. (2) By means of the Bureau of Education established in 1867 by act of Congress largely through the efforts of Henry Barnard "for the purpose of collecting such statistics and facts as shall show the condition and progress of education in the several States and Territories and of diffusing such information respecting the organization and management of school systems and methods of teaching as shall aid the people of the United States in the establishment and maintenance of efficient school systems and otherwise promote the cause of education throughout the country." Barnard became the first United States Commissioner of Education and organized the Bureau upon the lines along which it has ever since been administered. The Bureau has no control over the educational policies of the States and must work entirely through the force of suggestion and exposition. But by means of its collection of statistics, its comparison of systems, domestic and foreign, its description and evaluation of experiments in education, it has wielded an enormous influence in securing improvements simultaneously throughout the country and unifying the State systems of education. It is relevant here to mention that the great confidence everywhere displayed in the work and recommendations of the Bureau is due to a great extent to the splendid personal and professional influence of Dr. William T. Harris who was Commissioner from 1889 to 1906.

Another unifying influence upon education in the United States is the National Education Association (q.v.). The 25,000 members are enrolled in every State of the Union and represent all parts of the educational system, elementary, secondary, higher and professional. The meetings of the association which are held alternately in the East and the West provide an opportunity for exchange of opinion upon the results of educational experiments, for the putting forth of new ideas upon organization, administration, curricula and discipline and for decision as to the policies and principles which shall guide the teachers of the country in their efforts to promote the public welfare. One of the most efficient contributions of the association to educational progress consists in the reports made on particular problems by special committees which have studied them in the interim between annual meetings. The report of the Committee of Fifteen has become the basis of the course of study for elementary schools in every State of the Union and the report of the Committee of Ten similarly for high schools. It can be readily understood why as the result of the influence of a number of agencies, chief among which are the National Educational Association and the Bureau of Education, there exists in the United States a truly national system of education. In their general features and in many of their details the State systems of education show a remarkable resemblance. A comparison of the curriculum of a city school system in the East with one in the West or North or South would show almost an identity. Where differences exist it is usually due to the willingness of progressive communities to undertake experiments which, if they turn out successful, will be rapidly imitated by other communities.

SUPPORT OF SCHOOLS.

The munificence of the support given to public education in the United States is as great a source of amazement to foreigners as it is of gratification to Americans. We have already described the generosity of the Federal government to this activity, but the large sums given by it are small in comparison to the amounts raised for it by local and State taxation. The major part of the money devoted to education is raised by local taxation and averages from 20 to 25 per cent of the total amount. What this means for the cause of education is made clear when one learns that the appropriation for school purposes by the municipal government of New York city in 1916 was $42,000,000. The State government adds to the local appropriations grants for a variety of purposes provided the localities maintain standards demanded by the State Department of Education. In the case of New York State this amounted in 1912 to over $5,000,000, distributed in such a way that poor or small districts receive an advantage over large and wealthy ones, and New York State is no more generous in this respect proportionally than other northern States. What the total amount spent for public education in any year is would be difficult to say accurately, because uniform standards of estimating costs have not been adopted by all States or localities, e.g., some

local areas include interest on bonds and others do not. But according to the reports of the United States Bureau of Education (from which all statistics appearing in this article have been taken) the total estimated cost of education in the United States for 1914 was $794,459,968. What is undoubtedly true is that there has been a remarkable increase in the cost of education during the past two decades, amounting according to conservative estimates to 100 per cent. This has been due not only to the high cost of buildings and equipment and to increase in salaries, but to improvements in school organization and equipment to which we must now turn our attention.

EDUCATIONAL ORGANIZATION.

There were, in 1914, 19,561,292 children in the elementary schools, of which 17,934,982 were in public schools. The school curriculum under which these children are taught is practically the same everywhere in the United States. The elementary school maintains a course of eight years preceded in many cities and towns by a year in the kindergarten. The child usually enters the elementary school at six and graduates at 14, if he passes through according to rule. But careful studies of elementary education made by experts during the past decade have demonstrated the existence of excessive retardation and elimination of pupils. This discovery has resulted in two movements which are gaining in strength daily. One is a change in the subject matter of the elementary school curriculum with the object of emphasizing the useful and eliminating the purely academic. The amount of time allotted to the so-called disciplinary subjects like formal grammar and arithmetic has been reduced in favor of such subjects as manual training and domestic science. The other movement which is a corollary to the first, is to complete the general elementary course in six years and devote the last two years to vocational courses, commercial, industrial and academic, leading respectively to business, the trades and the professions. This in turn has caused, as we shall now see, changes in the organization of the secondary education.

About 7 per cent of the children who enter the elementary school pass on to the high school. In 1914 there were 1,373,661 pupils in the secondary schools, of which 1,218,804 were in public high schools. Until about the beginning of the 20th century the curriculum of the high school was everywhere the same, being organized for the few who intended to go to college. In other words, the high school was a preparatory school whose content of study was dictated by the college, although less than 10 per cent of those who entered the high school went to college. As a result of the strong movement in favor of industrial and vocational education that arose about 15 years ago, most of the large cities now maintain, in addition to the regular academic high school which prepares for college entrance, a commercial high school and a manual training high school designed respectively for business and technical pursuits. Smaller cities and towns maintain in their high schools commercial and technical courses in addition to the academic course and most States are now supporting agricultural high schools. Until about six years ago, the standard high school course of all kinds was four years in length and was built upon the eight-year elementary school course, but as a result of the movement mentioned above in connection with the elementary school, viz.: to finish the general elementary course in six years, another movement has arisen in the past few years which bids fair to have an important influence. This is the junior high school movement sometimes referred to as the six-and-six plan. The principle at the basis of this movement is excellent pedagogically as well as as administratively. It is felt that the study of certain subjects should be begun earlier than in the present academic high school, e.g., algebra and geometry, and particularly languages in order to take advantage of the greater plasticity of the vocal organs. Our practice would then conform to that of the European countries. It is also maintained that were the courses leading to vocations differentiated at 12 years of age and their elements well organized for a three-year period, many boys and girls who find the ordinary academic course unattractive would remain to the close of the period and perhaps be induced to continue their studies in the three years of the senior high school. In a large city the junior high school would also have the administrative advantage of relieving the congestion in many elementary schools by removing the boys and girls who must stay under compulsory education laws until they are 14 into a few buildings scattered about the city. Although the junior high school is a very recent experiment in secondary education and chiefly popular in the West, it is in accord with present tendencies and will probably be generally adopted in its present form or in some modified form.

Higher education in the United States is closely articulated with secondary. In 1914 there were 216,493 students in the colleges and universities of the United States, of which but 87,820 were in public institutions. Of the 67,066 students in professional schools, but 12,289 were in public institutions. The graduate of the ordinary high school who wishes to continue his education may go to college where he spends another four years in general education before taking up his professional studies or he may go directly to the professional school and finish his scholastic career in three or four years and enter upon his life work at 21 or 22. A few of the large universities of the East demand the bachelor's degree for admission to their professional schools, which means that the student can hardly enter upon his career until 25 or 26. In conformity with the recent demand that young men and women be prepared to earn a livelihood at an earlier age, some of these universities permit the first year of the professional course to be elected as the senior year of the undergraduate course, and Columbia University now grants both the bachelor and the professional degree for a six-year course. This has given additional stimulus to the junior college movement started some years ago by a number of Western universities particularly Chicago and California. According to this plan the first two years of the college course is formed into a junior college with a prescribed course of study looking toward pro-

fessional studies. The junior college movement has also afforded an opportunity to some small and poorly endowed colleges to restrict their efforts to the work of the freshman and sophomore years and affiliate with a large institution having a senior college, e.g., a considerable number of colleges in the Mississippi valley have entered into junior college relations with the University of Chicago.

The development of the junior college is only one evidence of the spirit of social service that animates the higher institutions of education in the United States to-day. The college is no longer content to be a place devoted solely to giving students culture and mental discipline, and the university a place to train men for the learned professions. Curricula and organization are constantly undergoing revision in order better to meet the needs of society and to solve its problems. The development of graduate schools, research departments, schools of commerce and finance, summer schools, extension work, correspondence schools and seasonal courses, show the extent to which the college and university are being socialized. Although this is particularly true of the State universities which exist west of the Alleghanies, it is becoming increasingly true of the urban institutions that have grown up in the East whether under private or public support.

One of the most important features of public education in the United States is the training of teachers. This is done chiefly by the State normal schools, city training schools and departments of education of colleges and universities. In 1914 there were 95,286 students in the normal and training schools, of which 89,537 were in public institutions. In every State, public school teachers must be certified under State laws, and, although in some of them positions in the rural elementary schools may be secured with a minimum of preparation, the tendency is everywhere to demand professional training. This training is becoming uniformly a two years' pedagogical course based upon high school graduation. Until a decade ago the only requirement to teach in the public high schools was an ability to pass an examination in the subject which the applicant wished to teach. But the National Education Association has gone on record in favor of requiring the bachelor's degree and most of the larger cities now require that and some professional training in addition. In 1914 in all departments of education there were 706,152 teachers, of which number 537,123 were women and 169,029 were men.

Parochial and Private Schools.— In the United States there is no monopoly of education by the State. Churches, corporations and individuals are permitted to maintain schools, the State merely demanding that these schools maintain a certain standard of work. Several of the religious denominations have thoroughly organized systems of schools, especially the Roman Catholics and Lutherans, both of which maintain that religious and secular education must be given at the same time and by the same agency. In support of this principle the Roman Catholics spent last year approximately $35,000,000 for the instruction of a million and a half of its children in 67 colleges and 985 schools, and the Lutherans a proportionately large sum for the instruction of one quarter million children. The Roman Catholic schools are most numerous and strong in the New England and the Middle Atlantic States, the Lutherans in the Middle West. Until the beginning of the 20th century, the appropriation of public funds for the support of these sectarian school systems was in many States a burning question, but in almost every case where it came to an issue it was defeated, and now more than half the States have constitutional provisions prohibiting the appropriation of public funds for any sectarian purposes.

There is no general system of private schools in the United States such as exists in England, and the number of private schools engaged in elementary education is comparatively small. But about one-fifth of all schools engaged in secondary education are under private endowment. Though a few of these are vocational in character, the great majority are preparatory schools fitting young men and women for college. In higher education the proportion of public and private institutions is reversed, less than 20 per cent being upon public endowment, though among these are the great State universities like Wisconsin and California. Of the 800 institutions in the United States which bear the name "college" but 261 have an endowment of more than $100,000 and a student body of more than 100. About half of the others are glorified high schools which may in time become junior colleges. Too much credit cannot be given to the remaining small colleges scattered throughout the country which give a higher education to the young men and women of the immediate locality who would have been unable to go to a university at a distance. For this and other reasons there will probably always remain an important place for the small college in American education despite the immense growth of the State universities and of the endowed universities.

One of the most significant features of American education as compared with foreign systems is the immense sums of money given for educational purposes by private benefactors. Because of the splendid public support of elementary education, practically none of this money goes to that form and only a comparatively small per cent to secondary education. But in 1915 almost 25 per cent of the entire income of the 550 institutions deserving the name of college or university came from private benefaction. What is still more remarkable is that for the past 20 years the average annual gifts to education amounted to 50 per cent of the gifts to all forms of philanthropy in the United States. These gifts vary in size from a few hundred dollars to the many millions necessary to establish a fully equipped university like Chicago, founded by John D. Rockefeller, and Leland Stanford, founded by Mr. and Mrs. Leland Stanford. The amount contributed during 1914 was $31,357,398, the largest in our history. Not all this money has been given to teaching institutions. In some instances new education agencies have been established, like the General Education Board organized in 1903 by Mr. Rockefeller with an endowment of $32,000,000 for its work in helping education in the South and assisting higher education generally; the Carnegie Institute (1902) with an endowment of $12,000,000 to encourage research

and discovery; the Carnegie Foundation for the Advancement of Teaching (1905) with an endowment of $15,000,000 to pay retiring pensions to college professors; the Russell Sage Foundation (1905) with an endowment of $10,000,000, a large portion of which is devoted to educational purposes. These and similar organizations have had an incalculable influence in fostering education in the United States.

Illiteracy.— It may seem very strange after reading this story of public and private munificence to education to learn that according to the Federal census of 1910, the percentage of illiteracy in the whole United States is 7.7 per cent considerably higher than the percentage of illiteracy in the countries of northern and western Europe with which the United States is usually compared in matters educational. Two things, however, should be remembered in connection with this matter, viz., that whereas the illiteracy among native-born whites is but 3 per cent, among foreign-born whites it was 12.8 per cent and among negroes it was 30.5 per cent. The South is working heroically to reduce illiteracy among negroes, and the North is spending immense sums of money for the same purpose with the newly arrived immigrants. The latter burden can readily be appreciated when one considers that of the 838,172 immigrants who came to the United States in 1912, over 177,000, or 20 per cent, were unable to read or write any language and very few were well educated. Fortunately the immigrants have so far shown a great desire to have their children go to school and the statistics of 1910 show that the percentage of illiteracy among the children of native-born parents is greater than among the native-born children of foreign-born parents. The fear of an ignorant citizenship which has been one of the great impelling forces to the generous support of education in the United States will continue to be a necessary incentive, now that our hordes of immigrants come almost exclusively from the ignorant population of southern and eastern Europe.

The Outlook.—In no country is education so active and vital an element in the life of the people as in the United States. Nowhere else do teachers show so strong a desire for self-improvement, parents so great a determination that their children shall take advantage of the opportunities offered, or citizens so great a willingness to bear the necessary expense. Education is everywhere marked by experiment: to determine the best system of organization, as the Gary System, or the best method of teaching, as the Montessori Method. And these experiments are not without philosophical justification, for in no other country is so much attention being given to the reorganization of educational theory as in the United States by such thinkers as John Dewey, G. Stanley Hall, E. L. Thorndike, C. H. Judd and others. Not only has astonishing progress been made in providing proper education for those who differ widely from the normal, such as the blind, the deaf, the dumb, the crippled, and the feeble-minded, but the experiments of to-day have as their object the discovery of the best methods and organization to meet the different needs of individual normal children. In other words, real progress is being made toward the realization of the American educational ideal, viz., so to organize education that the capacities of every child shall be discovered and the necessary training given to develop those capacities to the utmost, to the end that every individual shall be doing that in life for which his native abilities fit him.

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EDUCATION AND THE WAR. The present European War is affecting education to a far greater extent than wars of the past. This is inevitable because never before have the foundations of world civilization been so shaken. Inasmuch as education, its philosophy, institutions, and practices must in the long run express the spirit and forms of the civilization on which it acts, any far-reaching changes in the nature of that civilization will be reflected in education. The immediate effects of the present war on education are similar to those of previous wars, but on a much larger scale, due to the magnitude of the conflict. The essential external elements of education are teachers, pupils, and money needed to carry on the work of educational institutions. War demands the service of teachers and pupils for the army and navy and for the industries upon which these fighting forces depend — agricultural, manufacturing, and extractive. The immediate result is a shortage of teachers, a decrease in the enrollment of pupils in all classes of schools, particularly in secondary and higher institutions; and an actual decline in the number of institutions) for not a few have been obliged to close their doors entirely for the period of the war at least. The increased cost of carrying on education in a régime of rising prices, a common phenomenon in war time — the cost of labor, supplies, salaries, etc.— affects education adversely. Moreover, the shifting of labor to those industries where wages are high draws from educational institutions both teachers and others connected with the schools. The rise in the cost of living also prevents parents from keeping their children in school, so that there is a tendency for fewer pupils to pass out of the elementary to the secondary higher schools. These factors tend to decrease the quantity and quality of education and the number of courses and subjects available for study. In the higher institutions less promising material remains from which the leaders of the

future must be trained. Thus the war has brought on a national emergency in education which has led to earnest efforts to provide, in part at least, adequate remedies.

Higher institutions of learning, for example, have very generally modified existing and introduced new courses. Examples of modified courses, taught with a view to making them contribute directly to the war, are those in topography, chemistry, physics, medicine, engineering, psychology and French. In these subjects emphasis is laid on the construction and interpretation of military maps, telegraphy and telephony, war surgery and infectious diseases common in war, sanitation and hygiene, bridge and highway engineering and surveying, chemistry of foods, gases used in warfare, dietetics, psychological tests, and military conversational French. New courses, not before customary, include those in military tactics, ordinance, storekeeping, military history and historical courses directly on the war, both from the European and American point of view. A large amount of research work along special lines has been carried on as a result of direct requests of the government.

Remedies suggested by the government to meet the emergency, in many cases already adopted, include appeals to elementary, secondary and higher institutions to fit their educational policies to war needs. That of the Commissioner of Education, 22 May 1917, is notable, "Suggestions for the Conduct of Educational Institutions During the Continuance of the War," urging enforcement of school attendance laws in elementary and high schools, suggesting continuation classes and evening schools for minors and adults, requesting normal schools to double their efforts to train teachers, and advising higher institutions to reduce expenses, keep open all the year, to lay special emphasis in summer schools on courses adapted to war needs to stimulate research, and to prevent the scattering of the faculty or student body so far as possible.

The President, on 20 July 1917, urged colleges and technical schools to maintain their courses on the usual basis in order that every opportunity might be given for the training of the leaders on whom must fall the serious work of reconstruction. Likewise we may note the appeal of March 1918, signed by the Secretary of War, Secretary of the Navy and others, urging that boys and girls be kept in elementary and secondary schools until 18 years of age, because the future requires that these pupils have more and better education to cope with the problems of peace.

A second remedy is the plan to use the school plants to their maximum capacity, that is, all the year around, with the year divided into four quarters of 12 weeks each. Moreover greater use of school plants is urged for late afternoon and evening classes, both for minors and adults and the use of assembly rooms for lectures connected with the problems of the war, such as conservation, production, savings and thrift. Numerous school plants have been used for the training of those entering the war, for both military and industrial services and for the production of war materials — for use of the Red Cross, for example. There is also greater use of the school plant as community centres and as meeting places for the various organized bodies directly or indirectly connected with the school, whose work contributes to the war. This intensive extension of the functions of the school is seen in the formation of such organizations as the Junior Red Cross, Boy Scouts, War Savings, Liberty Loan, and War Garden clubs.

A third remedy is to change the point of view in teaching so far as it centres on local, State, or sectional interests rather than on national interests. President Wilson, in his letter of 23 Aug. 1917, asked the school officers and teachers of the country to stress the problems of community and national life because they are the most pressing problems now before us and will be still more so in the future. This tendency to emphasize national ideals is one of the most important of the changes brought on by the war. The fact that we do not have a national system of education has tended to divert attention from national interests and ideals. One of the immediate effects of the war, however, is to place emphasis on the duties and obligations of citizenship rather than on the privileges and rights of the individual. Considering the origin of the nation, the importance attached to individual rights in the period of the American Revolution, the slow growth of the national ideal, and the fact that education itself is under State control, it was natural that this point of view was neglected. But war is one of the greatest integrating and unifying forces, and tends to counteract racial, religious, party, sectional and class divisions, the disintegrating forces in national life, in order that the whole strength of the people may be used to overthrow the common foe. It places first the interests of the largest group, the nation, instead of individual interests, or those of a group seeking some selfish or local end.

Another principle affecting education is the new conception of the relation of the individual to the nation because of the immediate demands of the war. As public opinion changes, as the lessons forced on the people by the war are learned, education necessarily reflects these changes. The war has emphasized not only the matter of duties and obligations, but the principle of obedience and the performance of definite and often disagreeable tasks. This is in contrast to the notion present in the educational philosophy of the past generation, that pupils should do only those things which interest them. The exacting demands of war and the performance of uncongenial tasks required as a part of the training to gain skill and knowledge; the subordination of the individual to the group, to gain efficiency and success — these principles tend to react on educational philosophy, methods of instruction and the requirements made of the pupil. The effect on public opinion of the campaign for saving and economizing in money, time, food and clothing tends also to influence school practice and ideals.

Broadly speaking, the war has emphasized two types of education which compete more and more with the older cultural variety. The first grows out of the emphasis on national ideals and interests, and the duties and obligations of citizens to the nation in peace and war. This may be called the new social-civic education which has for its basis the socializa-

tion of the pupil through the study of the social sciences, history, civics, economics and sociology. It is through emphasis on these subjects that the pupils can be taught to take the social rather than the individual point of view; to become interested in, and to sacrifice for, the interests of the group. The new interest in history and civics is the first outcome of this force. It is agreed that the subject of history assumes great importance because the ideals for which we are fighting must necessarily be taught to the present generation. This calls for a revaluation of our own history as well as a broader study of the origin and development of our cultural and political institutions, and the development of democratic ideas. It also calls for a more complete knowledge of the history of the nations opposed to us, their psychology, philosophy, political systems and aims. It calls for a broader study of the history of those nations with whom we are allied in the war. It calls for a restudy of our own history, especially with respect to an understanding of our indebtedness to England for the origin of many of our institutions and much of our culture, to remove false prejudice and to show how under the forms of monarchy England is a democracy. The final attitude of the United States at the peace conference and in future efforts to preserve the world peace must, in the last analysis, be determined by public opinion. An enlightened public opinion is impossible unless historical conceptions are present in the minds of the people, sufficient for them to recognize what is just and right for the future existence of the nations and peoples who are concerned in the world peace. If the people of the United States are to help safeguard the world for democracy, it is obvious that the historical background of the struggle for democracy in the past and the manner in which nations have reacted to that struggle must be thoroughly understood.

Similarly, the necessity of studying civics, economics and social science is acknowledged, because citizens must know something of these subjects in order to react intelligently to the serious problems brought up by the war, to choose representatives who will vote for wise laws, and devise machinery for the solution of the great questions growing out of the war and reconstruction. Because of the war, our democracy is confronted with the need of more intelligent and better educated citizens in the political and social sciences than ever before were needed. For already the political, industrial and social practices and institutions of this country have been greatly changed. Whether the process will go on or whether we shall retrace our steps is a question which the generation now in our schools must help to decide. It is agreed that pupils must have a comprehension of the problems, difficulties, and tendencies facing us, in order to arrive at a wise solution and avert possible disaster. No more important questions could confront the people than those which relate to the permanent control of public utilities, railroads, telegraphs, telephones; the production, distribution, and consumption of food and fuel; the regulation of prices, and government control or ownership of other resources or agencies, and its relation to capital and labor.

The second type of education emphasized by the war is the industrial-scientific. The deeper causes leading to the war, especially those of an economic character, have called attention to the fact that industrial nations like those of western Europe, and even the United States, cannot prosper in peace or war without great attention to that phase of education which develops exact knowledge of and skill in the trades and processes on which an industrial civilization is based. The United States, broadly speaking, has been living on its capital, on the stored-up wealth represented by the natural fertility of the soil and the bountiful supplies of minerals and raw materials such as coal, iron, copper, lumber, etc. With such ready-made wealth, little technical skill, efficiency, or knowledge was needed for the supply of immediate needs or even for accumulating wealth. This era, however, has passed and this country, even now, must increasingly conserve its wealth and even depend on other lands for part of its raw supplies. It must apply more skill, knowledge, and efficiency in obtaining wealth from the soil, and in transforming raw materials into finished products. This condition, in connection with the competition of other racial groups who have attained still greater knowledge than we have, is at bottom the basis for the emphasis on technical, scientific, and vocational education. The 6,000,000 farmers in this country, and those who take their places, cannot succeed without more scientific and technical knowledge involving the chemistry of soils, problems of fertility, the science of growing larger crops, knowledge of the enemies of plant life and how to overcome them, the care of farm machinery, the production of better food and service animals, and the principles of scientific management of farms from the viewpoint of profit and loss. The reason for a great extension of agricultural education is obvious. But this means a very different rural system for education from that now prevailing, one that can only be introduced at great cost, and with the aid of the resources of all the people administered by the national government.

The intricacy of modern industrial processes, the greater and greater skill needed to obtain the required amount of wealth out of resources continually growing less, and the necessity of providing the great mass of industrial workers with the kind of education which will not only increase their skill and earning power, and hence the wealth of the nation, but also give them that broader vision and wider knowledge of their position and work, their privileges, duties, and obligations — all this is at the foundation of the demand for vocational education. It is significant that Congress passed the Smith-Hughes bill for Federal aid to vocational education in 1917, under the influence of the war and because of its effect on the type of education needed for a great industrial nation. This bill provides for the appropriation of large sums from the Federal treasury to stimulate the teaching of agricultural and industrial education, and home economics, and calls for an equal appropriation from the States taking advantage of the bill. It also created a Federal board for vocational education which has important powers of supervising the systems

established. This bill, if not directly a result of the war, was greatly influenced by it. It is the beginning of a new era in the United States, and must have important effects on national life, such as providing for the industrial skill needed for national defense, and for industrial competition likely to follow the war. It also lays the foundation for the vocational education of those soldiers who return. Particular subjects in the curriculum, such as geography, have been affected by the war. The result is a new interest in world geography, both as to the ownership of land areas and especially the economic resources of nations and their trade and commerce. The decline in the study of German in schools and colleges, and the increased attention to French and Spanish, is another important effect of the war on education.

The problems developed by the war, and the preparation for it, have led to increased study of the defects of our educational system with proposals to remedy them. One of the first results of the medical examination of those called to the colors was to reveal the fact that a larger proportion of our population than we realized, suffer from physical defects and diseases. That many of these could have been prevented by early attention, by medical inspection of school children, by greater care of their health, and by more attention to physical training by the schools is admitted. The question of the duty of the State to pay equal attention to both the physical and the mental well-being of its future citizens is more and more recognized. If this view is not one of the direct results of the war at least we may say that it has been greatly stimulated.

A second discovery growing out of the war was the fact that there was a large element of our population which had not only not been Americanized, but could neither read nor write English. The newly arrived immigrants who later became voters, as well as those who from choice remained aliens, were hardly touched by our public school system. The absurdity of granting citizenship and the franchise to one class, and allowing both classes to perpetuate their own foreign languages and culture, and even to pass these on to their children to the exclusion of our own language and culture, is now seen and appreciated. To expect that such a policy would make the United States safe for democracy, or to expect as a result of this policy that the nation would become unified in spirit, language, and ideals, so that it could act as a unit in a great crisis for its own self-protection, was foolish. Accordingly it is recognized that the function of the school must be extended so as to prevent such a condition in the future; that the school must extend its opportunities to immigrants and aliens, and indeed that education of emigrants must be made compulsory through continuation schools.

The problem of a teaching force that will be all American, loyal, and in sympathy with the ideals of this country has been brought to light by the war. The tendency to require public teachers to be citizens, and to be free from any taint of disloyalty or antagonism to the ideals of America, is an effect of the war. To teach successfully the ideals for which America now stands as well as the relation of these ideals to our historic past is obviously possible only for one who believes in no other ideals.

Finally there is the relation of education to the reconstruction period following peace. New political, economic and social conditions inevitably mean a new philosophy of education. The old order has even now actually passed, and it is hardly possible for it to return, because the conditions on which the old order was based have disappeared. The real propelling power of education is the prevailing political, economic and social forces of a period, plus environment. As these change so must education, its philosophy, curriculum, ideals, institutions, and practices. The war has already forced changes which must inevitably affect the future. Those changes which have taken place, such as governmental regulation of production, distribution and consumption of food and fuel, the principle of co-operation between the government and private industry, governmental regulation of labor supply and wages, and control of transportation facilities — all these mark the beginning of a new political, social and economic order, and hence a new order of education for the future.

National development in the immediate future will be determined largely by the educational plans and practices set in motion by the war — a new physical, industrial, and social training, extension of the principle of universal elementary to universal secondary education, so far as possible, with a corresponding increase in the proportion of those receiving a higher education, and the attempt to reach the whole adult population, through extension of the use of the school plant, various types of education, and continuation schools. This program may be supplemented in peace times by use of the great cantonments established by the government, for training men for the problems of peace as well as war, and for the rehabilitation of the disabled soldiers of the war. The proposed national department of education would do much to correlate existing agencies, to lay down the guiding principles which would standardize minimum requirements and make proposed improvements.

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EDUCATION OF WOMEN. The changes during the 19th century include none more significant than those in the history of education for women. So swift has been the transition that it is difficult to realize that until after the Revolution practically the only opportunities for a girl's education were found in the so-called "Dame Schools," where she was taught to read and sew, the 'New England Primer' being the chief textbook. Even the art of writing was not universal, as is shown by the number of wills, left by women of property, which were signed with a cross. The grammar schools, providing instruction sufficient to prepare young men for college, only occasionally admitted girls until the beginning of the 19th century. The exceptions were less than 12 in the first century of our colonial history, as shown by the records of nearly 200 towns in New England. The town of Medford, Mass., voted in 1766 that "The Committee have power to agree with the School Master to instruct girls two hours in a day after the boys are dismissed"; Dorchester in 1784 voted "that such girls as can read the psalter be allowed to attend the grammar school from the first day of June to the first day of October; and Gloucester in 1790 passed the following resolution: "And also that the master be directed to begin his school from the first day of April to the last day of September at 8 o'clock in the morning and close at 6 o'clock in the afternoon, or any 8 hours in the 24 as shall be thought the most convenient, but that two hours, or a proportionate part of that time, be devoted to the instruction of females — as they are a tender and interesting branch of the Community, but have been much neglected in the Public Schools of this town."

In Norwich, Conn., they were admitted "from 5–7 A.M."; and Nathan Hale, school-master in New London in 1774, writes, "I have kept during the summer, a morning school between the hours of 5 and 7, of about 20 young ladies: for which I have received 20 shillings a scholar by the quarter." This admission of girls at times during the day and year, when the schools were not needed for the boys, seems to have been common during the last years of the 18th century. Northampton, which had voted in 1788 "not to be at any expense for schooling girls," four years later voted "by a large majority to admit girls between the ages of 8 and 15 to the schools from May 1st to October 31st," and Boston, in 1790, opened the schools to girls during the summer months, when there were not enough boys to fill them.

One of the first advocates of education for girls was a graduate of Yale College in 1780, William Woodbridge, who took for the subject of his graduating essay, "Improvement in Female Education," and afterward opened an evening school for them in which he dared to teach such abstruse subjects as grammar, geography, and the art of composition. The founding of academies, to which girls as well as boys were admitted, is another evidence that in the latter part of the 18th century and the early part of the 19th, there was a new sentiment concerning their education. The first quarter of the 19th century might well be called the "Academy Age," since the most distinctive advance was in the founding of these institutions. The first one was at South Byfield, founded by bequest of a certain William Dummer, who died in 1761. Leicester, incorporated in 1784, Westford (1793), Bradford (1803), Monson (1804), were all coeducational at the beginning, although Bradford later excluded boys and has been for many years a school for girls. The so-called Academy at Medford, Mass., founded in 1789, is said to have been the first in New England for girls only, but was followed by others which became more famous such as Adams Academy in Derry, N. H., (1823), Ipswich Academy, in Massachusetts (1828), and Abbot Academy in Andover (1829).

Before the close of the 18th century there were efforts for the education of girls in other parts of the country; by the Friends in Rhode Island, by the Friends and Moravians in Pennsylvania, the latter founding schools in Nazareth, and as far south as Lexington, Ky. None of these institutions, however, aimed to give higher education to women; the academies prepared boys for college, but 200 years after the founding of Harvard College there was not a college for women in the country.

A movement for the higher education of women began about 1820. The Rev. Joseph Emerson, principal of the Academy at Byfield, had become noted for his championship of the cause and had attracted to the Academy women like Zilpah Grant and Mary Lyon, whom he inspired with zeal for learning as a preparation for service. In 1820 Emma Willard's 'Plan for Improving Women's Education' attracted the attention of Governor Clinton of New York, who secured the passage of two acts, one the incorporation of a proposed seminary at Waterford, and the other, "To give female academies a share of the literary fund," probably the first law passed by any legislature, expressly favoring women's education. The seminary was opened in 1821, not at Waterford, but at Troy, N. Y., as the Troy Female Seminary, later known as the Emma Willard School.

In 1822 Catherine Beecher opened a seminary at Hartford, Conn., in the upper room of a store. Beginning with 7 pupils, it soon grew to more than 150, and attracted students from all the States, but after 10 years was discontinued on account of Miss Beecher's removal to Cincinnati. Her interest in education was thus transferred to the Middle West, where for a generation she helped to mold public opinion on the subject.

From 1830–39 several institutions for the education of women were established, most of them in the South, the Wesleyan Female College at Macon, Ga., being authorized to grant degrees. In 1835 Wheaton Seminary in Norton, Mass., was founded by Judge Wheaton in memory of his daughter. His daughter-in-law, Mrs. Eliza Wheaton, instrumental in the founding of the school, lived until June 1905, its constant benefactor and a significant figure, as representing the last of the little group who, in the 30's, were laying the foundation of higher education for women.

Adviser and helper in the founding of this school was the woman who holds a foremost place among pioneers of higher education. Mary Lyon's reputation as student and teacher had already been won in the academies at Byfield, Amherst, Ashfield and Derry, and with Miss Grant in the seminary at Ipswich, but her chief work was in the founding of Mount Holyoke Seminary, Incorporated in 1836, and opened in 1837, in the

town of South Hadley, Mass., the seminary realized the ideal for which the founder had been working for years, that of a permanent institution for women which should furnish "every advantage that the state of education in the country will allow." The first curriculum, including the natural sciences, higher mathematics, logic, moral philosophy, ancient and modern history, evidences of Christianity and Butler's 'Analogy,' shows a decided advance since the days when Mr. Woodbridge was considered eccentric because he believed that women should be allowed to study grammar, geography, and composition. It marks an era in higher education, in the establishment of a permanent endowed institution, which should furnish to women, at moderate rates, as good educational opportunities as the colleges for men then offered. Its founding is not less significant in its influence as the "mother of schools." Among the institutions established on the same plan, with its graduates as principals and teachers, are the Western College at Oxford, Lake Erie College at Painesville, Ohio, and Mills College in California. Michigan Seminary at Kalamazoo and the Cherokee Seminary, in what is now Indian Territory, were also Mount Holyoke schools, while across the water they were founded in Persia by Fidelia Fisk; in Turkey at Marsovan and at Bitlis; in South Africa, where the Huguenot Seminary now Huguenot College, at Wellington, Cape Colony, is the most famous; and in Spain, in the form of the International Institute of Madrid, founded at San Sebastian, by Alice Gordon Gulick. Miss Lyon's influence is seen also in the establishment of Wellesley College, for Mr. Durant was a friend and trustee of Mount Holyoke and included many of its features in his own institution.

The intervening period before the Civil War saw the rise of numerous schools for the education of women, but only two of full collegiate rank to-day, Rockford College in Rockford, Ill., opened as a seminary in 1849 and chartered as a college in 1892, and Elmira College in Elmira, N. Y., founded in 1855 and authorized from the beginning to confer degrees. It is interesting to notice that most of these institutions were in the Southern States, a development cut short by the war. Within the last 30 years, three colleges for women of collegiate rank have been established in that section: Randolph-Macon College for Women at Lynchburg, Va. (1893), Agnes Scott College at Decatur, Ga. (1889) and Sweet Briar at Sweet Briar, Va. (1906).

The last 35 years of the 19th century were marked by an advance movement in women's education such as the world had never before seen. During this period three types of institution were developed:—

1. The separate women's college.
2. The women's college affiliated with the university or with the college for men.
3. Coeducation in the universities for men.

The first and second types are characteristic of the East and the third of the West, although the distribution is not entirely along sectional lines.

The Separate Women's College.—The conviction of Matthew Vassar, that "woman, having received from her Creator the same intellectual constitution as man, has the same right as man to intellectual culture and development," led in 1861 to the incorporation of Vassar College, opened in Poughkeepsie (1865) with more than 300 students, the first of the distinctive colleges for women authorized to confer degrees, with curriculum and endowment sufficient to realize its ideal of collegiate work. In 1875 two other colleges for women followed, Wellesley College at Wellesley, Mass., founded by Mr. and Mrs. Henry F. Durant, in memory of their son, and Smith College of Northampton, founded by Sophia Smith of Hatfield.

Within another 10 years a fourth college was established, Bryn Mawr at Bryn Mawr, Pa., founded by Joseph W. Taylor, and opening its doors to students in 1885. In 1888 Mount Holyoke Seminary was incorporated as Mount Holyoke Seminary and College, and in 1893 became Mount Holyoke College, the seminary course being withdrawn. The development of these colleges for women has been phenomenal. Each one has a beautiful campus, with fine academic buildings and residence halls, is well equipped, and offers a wide choice of elective courses, in addition to the required work, which varies somewhat in the different institutions. The faculty of each includes both men and women, with the latter in the majority. Two, Smith and Vassar, have had only men for presidents; two, Wellesley and Mount Holyoke, have had only women; and one, Bryn Mawr, had a man for the first president and a woman, the present executive, for the second holder of the office. The large number of applicants for admission has made it possible for these colleges to maintain a high standard of entrance requirements. Bryn Mawr admits only on examination; the other four colleges have admitted on certificate from accredited schools, a system which will be discontinued in 1919, in order to substitute the Comprehensive Examinations of the College Entrance Examination Board, although the Old Plan Examinations will also be allowed.

Other colleges in the East, somewhat smaller, but of high collegiate rank, are Goucher College in Baltimore, founded in 1888 as a Methodist institution, and Wells College in Aurora, N. Y., beginning as a seminary in 1868, but chartered as a college in 1870. The Western College at Oxford, Ohio, Lake Erie College at Painesville, Ohio, Milwaukee-Downer in Wisconsin, and Mills College in California, all beginning as seminaries but later chartered as colleges, are doing excellent collegiate work, although their numbers are small, as might be expected in sections of the country where coeducation is almost universally accepted.

More recent foundations in the East are Simmons College and the Connecticut College for Women. Simmons College, established by the will of John Simmons of Boston "as an institution in which might be given instruction in such branches of art, science and industry as would best enable women to earn an independent livelihood" was granted a charter in 1899. Its course of study is arranged in "programs — grouped in seven schools"—including Household Economics, Secretarial Studies, Library Science, General Science, Social Workers, Industrial Teaching and Salesmanship. The plan of instruction provides a four year program for students meeting its entrance requirements, a one or two year technical training for college graduates and provision for special students.

The Connecticut College for Women, located at New London, received its charter from the Connecticut legislature in 1911 and was opened in 1915. Its course for the degree of Bachelor of Arts or Bachelor of Science includes several branches of technical training, thus standing midway between the college of liberal arts and the more distinctive vocational colleges like Simmons. The college "owes its foundation to the wish and purpose of people of Connecticut to provide within the State adequate facilities for the higher education of women." The movement for its establishment was begun by members of the College Club of Hartford.

Another New England College for Women receiving its charter since 1910 is Wheaton College, formerly Wheaton Seminary.

The Women's College Affiliated with the University.— The college for women affiliated with the university, although the latest development, holds a place midway between the college on a separate foundation and coeducation.

The first to be established (1886) was the H. Sophie Newcomb Memorial College for Women, affiliated with Tulane University in New Orleans. Under the same board of trustees as the university, its buildings are in a different part of the city, its productive funds are in part separate, and it has a distinct faculty, including the president. The graduate department of the university has been entirely open to women since 1890.

The Women's College of Western Reserve University, Cleveland, is the outgrowth of an informal system of coeducation, established at Adelbert College, the undergraduate department of the university, in 1872. Sixteen years later women were excluded from Adelbert College, and provision made for them by the establishment of the Women's College. The fine buildings of the college, although separate, are near the other university buildings, and some of the laboratories of the men's college are open to women. The faculty, with the exception of the president, is distinct, but the university confers the degrees and opens all its graduate work to women.

Barnard College, affiliated with Columbia University, was opened in 1889, although 10 years before that President Barnard had urged the adoption of coeducation at Columbia College. As a result of his efforts and of a large popular petition in 1883, asking for the admission of women to Columbia College on the same terms as men, a system was inaugurated known as the "Collegiate Course for Women," which proposed to grant degrees to those who passed the college examination, but made no provision for instruction. The unsatisfactory character of this arrangement led to the establishment of the college, which, with a separate charter and an administrative autonomy, received Columbia degrees, took the university examinations and had university instructors, or those approved by the president. In 1900 another change was made by which Barnard bears the same relation to Columbia University as Columbia College, having its own faculty, endowments, and examinations, but receiving the university degree and being represented on the university council.

In 1891 the corporation of Brown University voted to admit women to the university examinations, but made no provision for instruction and took no action concerning the conferring of degrees. Unofficial instruction, however, was given by some of the faculty of the university during the first year and at least one woman was admitted to the regular classroom, a beginning which resulted in a vote of the corporation in June 1892 opening the degrees and all graduate courses to women. At the beginning of the second year a dean was appointed and a building for recitation purposes secured, where regular undergraduate classes were conducted by members of the university staff under the name of "The Women's College in connection with Brown University." The numbers had largely increased and four classes were graduated before the corporation formally recognized the college, by constituting it in 1897 a department of the university. The affiliation is a close one, since the faculty is composed of members of the university faculty, and the requirements, courses, examinations, and degrees are the same, thus carrying out the plan of the founder, President Andrews, who designed it not as an "Annex," but as "part and parcel" of the university.

Radcliffe College, in affiliation with Harvard University, although of the five colleges of this class, the last chartered to confer degrees (1894), was one of the first to make some provision other than coeducation for the admission of women to university privileges. Following the precedent of the English universities at Cambridge and Oxford, in 1879 the "Society for the Collegiate Instruction of Women" was organized in Cambridge, Mass., "for the purpose of providing systematic instruction for women by professors and other instructors in Harvard University." The students who completed the course received not a degree, but a certificate stating that the holder "had pursued a course of study equivalent in amount and quality to that for which the degree of Bachelor of Arts is conferred in Harvard College, and has passed in a satisfactory manner examinations on that course corresponding to the college examinations." There was no official relation with the university until 1894, when the society commonly known as "Harvard Annex," was incorporated as Radcliffe College and authorized to confer Bachelor's and Master's degrees, subject to the approval of the president and fellows of Harvard College. The president and fellows constitute the Board of Visitors having the general administration of the college, but the immediate government is in the hands of a council and an academic board, chosen mainly by the associates, who form the corporation. Thus its management is, in general, distinct from that of Harvard, although its instructors are entirely from the university staff.

To the list of affiliated colleges should be added William Smith College of Geneva, New York, opened in 1908 as a "co-ordinate" college. William Smith College is under the board of trustees and the president of Hobart College, the same faculty teach in both colleges, with the exception of instructors in the department of household arts and the degrees are the same. It has its own dean, and its classes, collegiate activities, and commencements are entirely separate.

In 1910 Tufts College in Massachusetts partially gave up the system of coeducation and opened Jackson College as a "co-ordinate" col-

lege, with general segregation the first two years of the course.

The affiliated colleges show certain differences in the character of their connection with the university. The chief administrative is generally the dean, only Radcliffe and the H. Sophie Newcomb Memorial College having a president distinct from the president of the university. All these universities open their graduate courses to women, and all, with the exception of Harvard, grant degrees on the completion of that work. In their development much has been accomplished by advisory boards or councils of women, who have collected funds for endowments, erected buildings, acted as advisers, and in many ways promoted their interests.

Coeducation in the Universities for Men. —To Oberlin College, Oberlin, Ohio, belongs the honor of being the first institution of collegiate rank to admit women. Opened in 1833 as Oberlin Collegiate Institute, it was coeducational from the start, although at first women entered the so-called "Ladies' Course," and were not candidates for degrees until 1837. The new departure aroused less comment, since "from the outset the new institution stood for so many unpopular ideas, social and theological, that the mere fact of the admission of both sexes attracted little attention." Its example was not followed for two decades, the second institution in this pioneer work being also in Ohio, Antioch College at Yellow Springs, founded by Horace Mann in 1853, and coeducational from the beginning. The movement, however, did not gain before the period of the Civil War; various reasons have been suggested for its rapid development since that time, such as the growth of the public school system, generally coeducational, and thus influencing public opinion in favor of the same policy in higher education, and the rise of the factory, relieving the home of many duties and leaving women more free for other interests. Throughout the country the demand for "practical education" was felt and the passage of the Land Grant Act in 1862, appropriating 10,000,000 acres for the endowment of colleges "to teach such branches of learning as are related to agriculture and the mechanics arts" is most significant in its influence upon women's education, since it was interpreted as providing for them as well as for men.

The West and the State universities have been the leaders in coeducation, only three of the latter, Virginia, Georgia and Louisiana, being still closed to women; but the East is not without representation in this class. When Cornell University was opened at Ithaca, N. Y., in 1868, the interest of Mr. Cornell and President White in favor of giving equal advantages to young women resulted in the offer from Henry W. Sage of a generous endowment on condition that "instruction shall be offered to the young women by the Cornell University as broad and thorough as that now offered to young men." In 1872 this offer was accepted and Cornell became coeducational.

The movement, however, had spread further east than the State of New York. In 1868 Boston University was opened, welcoming young women on precisely the same conditions as young men, the first institution in Massachusetts to take this step and, according to the report of the president, "the first in the world to open the entire circle of post-graduate professional schools to men and women alike."

Several other universities and colleges in the East are coeducational, among them Johns Hopkins, the universities of Pennsylvania and Maine, New York, Rochester and Syracuse, and Swarthmore, Adelphi, Bates and Colby colleges.

The opening of the University of Chicago in 1892 added another endowed institution of rank to coeducation; but in 1902, by the so-called "segregation" policy, which means separate instruction for women during the first two years of their undergraduate course, the university provision for them comes partially under the head of the affiliated college. This action, together with the limitation of the number of women admitted to undergraduate work at Leland Stanford Jr. University in California and at Northwestern University, Evanston, Ill., might be interpreted as a certain reaction in the West against coeducation were these policies not explained by the institutions themselves as efforts simply to preserve a proportionate relation in the undergraduate body. In the light of statistics the fear that the women students may outnumber the men is not unfounded.

The Commissioner of Education reports that in the academic year 1915–16 there were in the United States 144 colleges for men, with 43,851 undergraduate students; 89 colleges for women, with 20,638 undergraduate students; 341 institutions for both sexes, with 109,009 undergraduate men and 69,543 undergraduate women — in all, 574 institutions, with a total of 152,860 undergraduate men and 90,181 undergraduate women. The degrees conferred upon women by universities, colleges and technological schools in 1915–16 were as follows:

First degrees —

Arts and Sciences	9,309
Agriculture	135
Architecture	4
Commerce	46
Education	591
Fine Arts	14
Household Economy	639
Journalism	17
Music	368
Oratory	74

The higher degrees conferred upon women were as follows:

Master of Arts	909
Master of Science	56
Doctor of Philosophy	81

The total number of bachelors' degrees received by women was 11,240; by men 20,586. The total number of graduate degrees received by women was 1,062; by men 3,462.

In professional schools the numbers were as follows:

School	Number of schools	Students		Graduating in 1916	
		Men	Women	Men	Women
Theology	169	11,291	760	2,023	67
Law	124	22,306	687	4,220	103
Medicine	92	14,105	662	3,316	120
Dentistry	48	10,521	194	1,831	21
Pharmacy	71	5,688	346	1,667	129

The tendency toward the utilitarian is more marked in the coeducational institutions than in the separate women's colleges, a difference easily explained, since the step is a natural one, from the opening of a work-shop for the men students to the establishment of courses in domestic science for the women. The universities endowed by the land grant were the first to introduce the last-named subject and now form the majority of the institutions which include it in their curricula.

Early specialization is also more common in the coeducational college, the separate college placing greater emphasis in its undergraduate course upon liberal culture. The general tendency to-day, however, is away from unrestricted elective toward more required work, a "group" system, or a system of "majors," by which the student may have in her undergraduate course something more than a purely technical and hence one-sided training.

The results of education for women are shown in the large increase of numbers in the professions, the census of 1890 giving the number of women in professional service as 311,689, that of 1900 as 430,576, that of 1910 as 733,885, 44.1 per cent. of all the people in professional service. One of the chief reasons urged by the early champions of the movement was that they might be better qualified to become teachers and to-day their representation in that profession outranks all others.

The number of women who are given the higher positions in the profession of teaching, however, is not in proportion, as the following report for 1915–16 shows:

Professors and instructors in universities, colleges and technological schools:

574 institutions	Men	Women
Preparatory departments	2,399	1,418
Collegiate departments	19,140	4,246
Professional departments	7,653	95
Total (excluding duplicates)	28,472	6,397

Within the last few years there has been a large increase in the number and variety of employments which college women enter. They are not only teachers and physicians, but also nurses, superintendents of hospitals, secretaries, registrars and keepers of records, librarians, social workers, in settlements and associated charities, professional housekeepers, assayers and poultry-raisers. They have opened laboratory kitchens, laundries and greenhouses, have engaged in scientific and historical research, published books, become musicians and artists, deans and presidents of colleges. Nor has their interest been confined to the professions by which they might earn a living. A recent writer says that "between the two broad oceans there is hardly any significant movement outside of trade and politics which is not aided by unpaid women who work purely out of ideal motives." Educated women are interesting themselves in the problems of the cities in which they live, serving on boards of education and of sanitation, making possible public playgrounds and vacation schools, agitating the questions of improved tenements, pure water supply and clean streets. The experiment of college training for women has already justified itself by what they have accomplished in promoting public health and morals.

The Great War has intensified this call for college women. Laboratories which two or three years ago had no place for them, are demanding more trained workers than the colleges can supply. Positions as draughtsmen, accountants, social workers, government employees, farmers, dietitians, nurses and organizers for different kinds of work, are opening faster than the colleges can send out graduates to fill them. Never was there such real need of the educated woman.

The fear that academic training would unfit women physically and divert them from the home by the attraction of other careers has proved unfounded. The women's colleges and many of the coeducational institutions provide gymnasiums and regular physical training, require out-of-door exercise, and have careful physical examination. These provisions, together with the regular hours and systematic life of the college, mean a better physical condition than in the case of the average non-college woman.

To those who know the college woman in her home the question concerning her fitness for it is not debatable. The supreme result of the college training is the development of character and the cultivation of self-control, of consideration for others and of a more rational outlook, means preparation for the home as well as for the profession.

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EDUCATIONAL ASSOCIATIONS. The beginnings of educational associations in the United States antedated the public school system. Long before the organization of State school systems and before the days of the railroad when travel was of necessity by stage-coach, the great need of conference and exchange of thought was slowly being realized and in several States, particularly in New England and New York, county or other local gatherings of teachers and those interested in education were organized.

Of the educational associations in the United States having a national character, the American Institute of Instruction is probably the earliest. This association was organized in August 1830. The first meeting was held in the State House, Boston, Mass., and President Francis Wayland of Brown was the presiding officer. The first

seven meetings were held in Boston. They were marked by the presence of great leaders and educational statesmen rather than of those actually engaged in classroom teaching. Horace Mann, who was then a member of the Massachusetts legislature, attended the first meeting at Boston and became greatly interested in the discussions. The program attracted his attention and active support. As a result he turned from the law and from legislative halls and became one of our greatest educational leaders. Among those in frequent attendance on the early meetings were Horace Mann, Thomas H. Gallaudet, Henry Barnard, Samuel G. Howe, Asa Gray, Ralph Waldo Emerson, Theodore Parker, Charles Sumner, David P. Page, Edward Everett and many others whose names are equally familiar. The first few years these meetings in Boston were epochmaking, but discordant elements brought about a change in plans and for the next seven years the annual meetings were held in various New England cities. Through the influence of Horace Mann Massachusetts made an annual appropriation, at first $300 and later $500 for the expenses of the meetings. This was discontinued in 1874. With the rise of the State associations in 1845 the interest in the organization declined. It was desired to make the new State organizations more representative and popular but the dynamic influence of the great leaders who had been active in the meetings of the institute was lost. The interest in the institute was continued through the efforts of Rhode Island leaders. It was commercialized through the excursion idea which was made a feature of the meetings, and thus was enabled to continue from year to year, but unusual expenses and a very limited income from the membership proved a serious embarrassment. More recently, however, the membership has increased and the expenses have been reduced so that the period since 1900 has been more encouraging than at any time since the great leadership of its early days. The contributions of the American Institute of Instruction through the educational statesmen who were in attendance at the early meetings were beyond measure in developing public thought toward a rational educational program. In comparison with the larger State and national meetings the annual meetings of the institute have been small. It has seldom exceeded 2,000 members in enrolment. Although its history has been largely associated with New England, yet its membership has been drawn in part from many other States.

The Western Literary Institute and College of Professional Teachers which was organized in 1831 drew its membership largely from the four States — Ohio, Indiana, Illinois and Kentucky. Of the 15 annual meetings, 12 were held in Cincinnati, and 3 in Louisville. This association was very active and was supported by the strongest teachers in this section of the country. The spirit and thought of the meetings were progressive. The remarkable development of the new country reacted on the educational thought. There was a freedom from conservatism and women were permitted to take active part in the deliberations. The association continued until 1845 and exerted a wide influence on the schools.

The American Lyceum Association held its first national convention in New York city in 1831. It continued for nine years, when the last meeting was held in Philadelphia. The association was interested in general educational problems but more particularly in advancing improved methods, in creating an interest in the study of the natural sciences, in providing the schools with books and apparatus, and in emphasizing the importance of the education of women. Among the papers discussed on the programs were "Manual-Training Schools," "The Education of the Blind," "Vocal Music," "Eye Training," "Education of the Deaf," "Geology," "Female Education," "The Embellishment and Improvement of Towns." The programs were prophetic in character. The association created a wide interest in libraries and "lyceums."

The American Association for the Advancement of Education was organized as the result of a meeting of the "National Association of the Friends of Education" which held its first meeting at Philadelphia in October 1849. The conference was presided over by Horace Mann, then a member of Congress from Massachusetts. The purpose was to discuss the administration of public education in its relation to the needs in different sections of the country. The second meeting, also held in Philadelphia, convened in August 1850, under the presidency of Eliphalet Nott, president of Union College. At this meeting a new constitution was adopted, and the organization became the American Association for the Advancement of Education. The eighth, and probably the last, meeting of the association was held at Detroit in August 1856 under the presidency of Chancellor H. P. Tappen of the University of Michigan. The various meetings of the association were marked by the attendance of superintendents, supervising officers and college presidents. The representation from the actual teaching staff was probably small. A close relation is observed between the American Association for the Advancement of Education and the new State school systems which were being organized at that time.

The National Teachers' Association, organized in Philadelphia in 1857, absorbed the American Association for the Advancement of Education. The purpose of the new association was to include in one organization "all the teachers of our whole country." The original "call" was made "to all practical teachers in the North, the South, the East, the West" and was signed by the presidents of 10 of the State associations. It was to be an organization of the rank and file of the teaching profession, to bring together into one unit the common thought of the practical teachers in the schools, and through the national association to bind all the State associations together into one structure. The spirit of the new organization was in every sense in harmony with the efforts of the earlier associations both State and national. It conceived the need of a national conference representing the popular teaching body. A pregnant phrase in an address by William Russell at the first meeting at Philadelphia — "harmonious co-operation of educational skill with scientific progress and parental interests" — indicates the breadth of view of these early leaders. Two conditions made this the psychological time for the organization of the National Teachers' Association: the growing strength of

the several State associations, and the liberal legislation by which systems of public education had been established in several States. Moreover, the rapid economic development of the country through the application of scientific discovery and invention to the everyday life of the people, such as the marvelous extension of steam railroads and telegraph lines as well as the use of industrial machinery for the farm and home, made possible a real national conference and furnished a greater opportunity for the interpretation of the common thought. The strength in the association was in its appeal to popular membership. Its weakness was due to lack of educational leadership and statesmanship. The great impending national crisis overshadowed the activities of the embryo organization. There was, therefore, lack of popular interest and no conventions were held in 1861, 1862 and 1867. In 1866 an important change was made in the constitution whereby women were admitted to full membership on the same terms as men, and in 1869 two women were elected on the executive board of 35.

At the meeting in Cleveland, Ohio, in August 1870, D. B. Hagar of Massachusetts, who drew up the call for the convention of teachers in Philadelphia in 1857, was president of the association. In his opening address he outlined certain changes in the organization as a result of which a new constitution was adopted and the following departments were created: normal schools, school superintendence, elementary education, and higher education. By this action the American Normal School Association and the National Association of School Superintendents became, under the new constitution, departments of the National Education Association. From time to time other departments have been added until there are now 21. The breadth of activity is indicated by the names of some of the departments more recently organized: vocational education and practical arts, rural and agricultural, child hygiene, physical, school administration, library, special, promotion of wider use of schoolhouses. The growth, however, was slow. The registered membership at the Cleveland meeting in 1870 was only 170, and for several years the attendance continued small. The funds were frequently insufficient to print the proceedings. In 1884 an unusually successful meeting was held in Madison, Wis., with an enrolment of 2,729. This marked the beginning of a new era for the association. From that time it has properly been regarded as a leader in national educational matters. In 1886 the association was incorporated for 20 years. The following year at the Chicago meeting the membership totaled 11,297; at Los Angeles in 1899, 13,656; and at Boston in 1903, 34,953. In 1906 an act was passed by Congress incorporating the National Education Association. A permanent fund founded in 1884 has grown to nearly $200,000.

At the Philadelphia meeting in 1891, Dr. W. T. Harris, United States Commissioner of Education, presented a noteworthy paper on the organization and functions of the association, in which he reviewed its purpose, to "concentrate the wisdom and power of numerous minds, and distribute among all the experiences of all," outlined its progress and growth from a few hundred to as many thousand, mentioned the great "advantage of personal contact of mind with mind," and pointed out the salutary influence of the departments provided for the needed specialization of work with the suggestion that others should be added.

Since 1898 there has been a permanent paid secretary who gives his entire time to the service of the association, and since 1917 the secretary's office and the headquarters of the association have been located at Washington, D. C. It has always been the policy of the organization to support broad national policies. To formulate a program of education during and after the war, the association designated a Commission on the Emergency in Education. This commission contemplates no less a program than a national department of education, with a secretary who shall sit in the President's cabinet, and the transfer of all bureaus or agencies relating to educational affairs to the new department.

There have been organized in recent years several societies interested in the scientific study of education. The National Herbertian Society for the Scientific Study of Teaching was organized in 1895, and in 1902 it was reorganized and the title changed to the National Society for the Scientific Study of Education. The National Society for the Promotion of Industrial Education, organized in 1906, has also made large contribution to educational thought and progress.

Local teachers' associations had become general before the organization of the National Teachers' Association in 1857. A teachers' association was organized in New York city as early as 1798. An association of teachers known as the School Association of Middlesex County was formed at Middletown, Conn., in 1799. The earliest record of a State gathering of teachers is that a "State Convention of Teachers and Friends of Education" was held at Utica, N. Y., in January 1831. It was not until 1845, however, that there was a formal organization. Actively interested in the work of the State associations were many educational leaders. These men gave strength to the organizations, and every effort was made to secure a large attendance on the part of practical teachers. In Rhode Island, Massachusetts and New York State associations were organized in 1845. The Ohio association was organized in 1847; Connecticut, in 1848; Vermont, in 1850; Michigan and Pennsylvania, in 1852; Wisconsin, Illinois and New Jersey, in 1853; Iowa, New Hampshire and Indiana, in 1854; Missouri, in 1856. The meetings of some of the State associations soon became large and enthusiastic. Dr. Hagar of the State Normal School at Salem, Mass., stated that the attendance at the meetings of their association in the late 60's was from 2,500 to 3,500. He attributed this interest to the reorganization of the meetings into special sections. There is now a State teachers' association in every State except Delaware. The meetings are usually held annually. In the larger organizations the program generally covers several days. At the general sessions the topics are of broad interest, while the sectional meetings are given over to the discussion of special activities. In New York the State association is very strongly organized. Every effort is made to enroll a large membership. The cities, villages and the supervisory districts are the separate units of the State organization and are represented by delegates who control the poli-

cies of the State organization. Previous to the reorganization of the New York State Teachers' Association in 1913, the meetings were largely representative of the locality where the annual meeting happened to be held. The renewed interest and enlarged activities of the new organization have fully justified the change made in 1913. The association is now representative of the entire State and every supervisory unit, city village or rural community, has a representative voice in its annual meeting.

In some States the interest in the State association is much greater than in others. This is indicated in part by attendance and membership, which varies from nearly zero to 90 per cent of the teaching body of the State. Most of the associations are growing much stronger and teachers are becoming alive to the opportunities of an active professional organization. The economic conditions are rapidly becoming better for the teacher in those States in which the association is supported by a loyal membership. The indifference so often found is due in part at least to the short professional life of the teacher.

In general there are two types of teachers' voluntary associations: (a) the general associations which aim to promote all the interests of teachers, such as the National Education Association and the State teachers' associations, and (b) specialized associations which are limited to some special subject or to some particular activity of school work, such as kindergarten, industrial training, English, music, agriculture, domestic arts, science, health and hygiene, playgrounds, or others.

The early associations were largely cultural. They were not subdivided into sections, in fact, the attendance was so small that this was not possible, even if it had been considered. In recent years the national and State associations have differentiated their work until the sections have become highly specialized. Women play a much more prominent part than formerly. In 1911 the National Education Association had its first woman president. It was an incident worthy of mention that in the same year the National Union of Teachers of England and Wales had a woman presiding officer for the first time. Little thought was given at first to the economic and material needs of the teacher. In the State associations there is a great interest in educational legislation and also in the raising of professional standards. The teachers' associations in some of the larger cities are largely concerned with the economic betterment of their membership and related legislation.

Teachers' voluntary associations, both general and special, have made a large contribution to educational progress. To the teachers these associations mean renewed enthusiasm, professional growth and material improvement. To the State they are often the "greatest single educational factor." Active teachers' associations are essential to progressive educational policies.

In England a much larger percentage of teachers is represented in the associations than in America. The National Union of Teachers, which was organized in 1870, has a membership of over 70,000 teachers. More attention is given to economic conditions and material needs. It has actively supported candidates for Parliament and for a time its secretary was a member of Parliament. The membership was originally limited to teachers in elementary schools, but more recently the Union has been open to other teachers.

The Headmasters' Conference, organized in 1869, and the Association of Headmasters, organized in 1890, give special attention to questions relating to school management and professional matters. The Assistant Masters' Association is an organization of secondary school teachers and is interested in part in the economic betterment of its membership.

The largest general association in Scotland is the Educational Institute of Scotland. The Scottish Class Teachers' Association also has a large enrolment. The Association of Headmasters of Secondary Schools and the Secondary Education Association of Scotland are organized in the interests of teachers in the secondary schools.

There are various types of educational associations in France. Many of them illustrate the power in co-operation between teachers and others interested in educational problems. The League of Doctors and Families organized in 1902 for the improvement of scientific methods and hygienic conditions in the school includes in its membership teachers, parents, physicians and others. The Society for the Psychological Study of the Child, which was organized for the study of child psychology and general educational methods, includes not only teachers but scientists and others interested in a theoretical as well as practical study of educational questions. The work of these associations has brought about the organization of international congresses for the scientific study of educational questions. Associations of teachers and instructors in France have a wide influence. The discussions as to instruction, curriculum and discipline brought out in the meetings are published in their bulletins and principals are quite free as to the adoption of new methods in their schools.

The largest organization of its kind in Germany is the German Teachers' Association formed in 1871. Over 90 per cent of the teachers in the elementary schools are members of the association. It is highly organized throughout the country, including local associations of a general character and sections for teachers in special subjects. The chief interest is the professional and economic betterment of teachers. Its strength is in the centralized organization. There is also an association of secondary school teachers, the aim of which is to improve the conditions of teachers in schools of secondary grade. Associations which enlist the interests of the public-spirited citizen as well as the teacher and which aim to promote general educational activities are not found.

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EDUCATIONAL ATHLETICS. At the outset it must be borne well in mind that athletics in an educational institution is not an end but a means to an end. The end in view is to furnish a healthy habitation for a healthy mind, for without a sound body to carry out its work the mind certainly cannot do what nature intended it to do. Certain minds incorporated in crippled bodies, it is true, have risen to remarkable heights in the various fields of human activity, but not on account of deformities, but in spite of them. Perhaps there is nothing so detrimental to a good healthy body — not even the use of stimulants — as excessive sedentary pursuits. When a young man is bent on winning scholastic honors, he unconsciously falls into this excess. Of course the natural result follows. Good rich blood is denied the parts; they become starved, and in a short time degeneration sets in throughout the entire body. Then it is that we have a terrible spectacle of a strong intellect unable to do even ordinary work on account of a pain-racked body.

It is to counteract this tendency to starve the body in order to feed the mind, that school authorities have encouraged physical as well as mental training among students. Thus we see that to-day the gymnasium is as important a part in a group of school buildings as a hall of science or of arts.

Although educational athletics is found at its best in the university, and there is little difference between the systems employed in our leading institutions of learning, the question is far from settled as to the best way of exercising the boy in the elementary and high school. It is a generally accepted fact that the exercise — we can hardly dignify it by the name "athletics" — in the elementary school is the one which, apparently, has the least system about it.

Athletics reduced to a system is for the first time found in the high school. The games played are much the same as in the college, namely, baseball, football, track sports, tennis and basketball, while in some of the high schools we find indoor baseball. As a rule all interscholastic competition is under the control of the school principal, or a member of the teaching force appointed by the principal.

All over the country there are interscholastic associations made up of high schools in adjacent counties. The winners in the respective meets compete in larger meets under the auspices of the athletic associations of some nearby university. In many of the Western States, State high school track meets are held annually by the various State universities. Beside the rivalry between high schools located in the same section, there have been contests between the champion football teams of the Middle West and those of the East.

Generally speaking, every university in the United States has the same routine. Each student is required to undergo a physical examination, so that a correct knowledge of his bodily condition is obtained and proper exercises prescribed. Regular classes are formed for drill in ordinary arm, body, leg and wand calisthenics, and then on the various gymnasium appliances and apparatuses. During the freshman year at least, gymnasium work is compulsory. Exceptions, however, are made in the cases of those who make athletic teams. Besides the exercises themselves, lectures are given on personal hygiene. If the college is a co-educational institution, the female students take physical training under a competent woman instructor. In several institutions young women have taken part in basketball, and in rarer cases in track athletics, and on several occasions have made enviable records.

All competitive athletic games are given under direct faculty supervision, and examination is required to show that the membership on any team will not cause injury to the student, but will tend to improve his physical condition. No student, whose class work is unsatisfactory, is allowed to play on a university team. No student is permitted to play on an athletic team more than four years. All those who take part in collegiate sports must be amateurs.

Of all intercollegiate sports the most popular and the one most distinctively a college sport is football. The football season begins in the middle of September and ends with Thanksgiving day. Intercollegiate contests begin about the first of October, since the last half of September is taken up with the training and conditioning of the players. Football, as it is played in colleges to-day, is a modification of the Rugby game. This country first saw it at Harvard in 1875. A match was arranged with Yale that year, and the latter was beaten. However, the lesson seemed to have been a good one, for since then Harvard's victories over Yale have been few and far between. To Walter Camp, Yale 1880, sometimes called "the father of football," do we owe much for football as it is played to-day. It was due principally to Mr. Camp's efforts that the number of players on a team, and positions were fixed in their present condition. Without going into a discussion, on the roughness of the game, let it be considered that what is rough — nay, brutal — for a man in no condition to play, is merely a trial of strength, courage and cleverness, in which all unnecessary roughness is eliminated, for the trained athlete.

After the football season is over, beside work in the gymnasium, there is nothing done in the way of exercise until after the holiday vacation, when the various indoor or gymnasium sports are taken up. The principal winter sport is basketball and gymnasium work. It is very important, among other things, in that it brings out a part of the student body which takes no part in the other branches of sport. Gymnasium teams practise in tumbling, trapeze, horse and bar work. Many of the students also take special interest in wrestling, fencing and boxing. Although there is none or little intercollegiate competition in handball, this beneficial exercise is the principal mode of recreation for a great many of the student body.

Although it is long before the season of competition, the training season of both the baseball and track teams start immediately after the Christmas holidays. Baseball brings out more candidates than any other branch of sport, and the reason for this may readily be seen. Although there are many boys in college who have never played football, or sprinted, there is hardly one, physically able, who has not played the national game. The indoor work in this branch consists of batting, throwing, picking up grounders and pitching. The squad, which in some instances numbers

more than a hundred men, is gradually cut down, so that when they are able to play out of doors, in March, there remains probably enough men to make up two teams, beside the men who are trying for pitching positions.

In the East, Brown, Yale, Harvard, Princeton, Georgetown and Holy Cross have always been among the leading schools in baseball. The baseball squads in almost all of these colleges are coached by professional players. In the West, Illinois and Michigan have divided all the diamond honors in recent years.

Training for a track team starts in the winter. Almost every university gymnasium is fitted up with a running track. There, day after day, the candidates for the team get out and run under the eye of the trainer. Intercollegiate indoor track matches begin as early as February. They take place in the gymnasium, and consist of short dashes, hurdle races, middle and long distance runs, shot put, pole vault and high jump. To this list is often added a relay race. As soon as the weather is warm enough the track candidates are taken out on the athletic field. During the spring dual meets are held, and in June, at the end of the collegiate year, a meet is held to which all the track teams of the colleges of a section are invited to compete.

Harvard, Pennsylvania, Yale and Georgetown do the best work on the track in the field among the Eastern colleges. In the West Michigan and Chicago usually fight it out for leadership.

The following are the best records made in the respective events by the college track athletes of the country in collegiate meets:

100 yards—9 4-5 s.—W. W. May.
220 yards—21 1-5 s.—B. J. Wefers, Georgetown.
One-fourth mile—47 2-5 s.—J. E. Meredith, Pennsylvania.
One-half mile—1 m. 53 s.—J. E. Meredith, Pennsylvania.
One mile run—4 m. 14 2-5 s.—J. P. Jones, Cornell.
Two mile run—9 m. 23 4-5 s.—J. S. Hoffmire, Cornell.
120 yard hurdles—15 s.—F. S. Murray, Leland Stanford.
220 yard hurdles—23 3-5 s.—A. C. Kraenzlein, Pennsylvania.
Running high jump—6 ft. 4¼ in.—W. M. Alex, Yale.
Running broad jump—24 ft. 4¼ in. — A. C. Kraenzlein, Pennsylvania.
Pole vault—13 ft. 1 in.—R. Gardner, Yale.
Putting 16 lb. shot—48 ft. 10¾ ins.—P. Beatty, Columbia.

Beside the sports already mentioned, rowing takes an important place in the athletic catalogue of many universities. Perhaps a man has to train longer and more strenuously to make a college crew than if he went into any other branch of sport. Often the man on the crew starts to work in September and continues throughout the entire college year. The swimming tank in the gymnasium leads to many water games, such as racing, diving, water polo, etc., all of which tend to mould a man along healthful lines. Lawn tennis occupies a very important place in college athletics. It is one of the most beneficial sports we have, but as it is not a game which is very interesting to spectators, it will never rank with football, baseball, rowing or track athletics as an intercollegiate sport. Golf is being taken up more and more by the colleges and this most excellent game will increase in popularity, and we will hear of many intercollegiate matches where now there are but few.

The good of athletics in institutions of learning is incalculable. Between classes and lectures, when there is nothing to take up the student's mind, the temptations are manifold. If he is of a studious disposition, there is the danger of excessive sedentary life. If he is not studiously bent, there are many temptations to attract the idle. If he is of a weak constitution, disease and its consequences soon follow; if he is robust, although he may stave them off longer, the consequences are the same. Then again, the athletic field is a place where all classes of students can meet on a common ground. It is the place where they can get rid of a superabundance of youthful enthusiasm. As a result, the town and gown riots, which formerly characterized every college town, are things of the past. One is thus inclined to agree with an eminent college president when he said, "the athletic field does more toward keeping order in the student body than all our rules and regulations combined."

EDUCATIONAL LAND GRANTS. See LAND GRANT COLLEGES; EDUCATION, AGRICULTURAL — *Land Grant Colleges.*

EDUCATIONAL PERIODICALS. Professional publications designed for the use of teachers first appeared in the early part of the 19th century. Their development has been closely associated with the organization and growth of educational associations. The pioneer educational magazine of America was the *Academician*, a small semi-weekly edited by Albert and John W. Picket and published by the Incorporated Society of Teachers of New York. The first number appeared 7 Feb. 1818. It published a series of articles on grammar and another series on mathematics; articles on Pestalozzi's methods and accounts of various institutions of learning. It continued for two years, the last number appearing on 29 Jan. 1820. The second in the field, *The American Journal of Education*, a monthly periodical edited by William Russell, W. C. Woodbridge and William A. Olcott, was begun in January 1826, and until 1838 exercised marked influence on the educational thought of the country. In the latter year, Horace Mann, then secretary of the Massachusetts State Board of Education, commenced the publication of the *Common School Journal*. As the mouthpiece of the great educational reformer this magazine did much to advance the teaching profession. It was discontinued in 1852. In the meantime several minor educational publications had sprung up in different States. Most of these exerted but a local and transitory influence. The most remarkable educational periodical ever produced in this country was Henry Barnard's *American Journal of Education*, which was started in 1855. This was more than a magazine; it was rather a compendium of the educational thought of the day. It continued with some irregularity until 32 volumes had been completed. The plates were preserved and the whole work was reprinted for library use. With the expansion of the teaching profession educational periodicals have multiplied until every department of education has its special journal. The best known of the current journals covering the general pedagogical field in America are *The Educational Review*, (1890), *Education* (1880), *The School Review* (1893), *Journal of Education* (1875), *School Bulletin* (1874), *American Education* (1897), *Catholic Educational Review* (1904). Among the magazines

covering special phases of educational work the following have a prominent place: Administration—*American School Board Journal* (1863), *Educational Administration and Supervision* (1915); elementary—*The Elementary School Journal* (1900); *Primary Education* (1892), *American Primary Teacher* (1870), *Normal Instructor and Primary Plans* (1891); psychology—*The Journal of Educational Psychology* (1910), *The Pedagogical Seminary* (1896), *The Psychological Clinic* (1906); physical education—*American Physical Education Review* (1896); kindergarten—*The Kindergarten Magazine* (1888), *The Kindergarten and First Grade* (1916). In addition to these there are many state and local educational periodicals of much merit. Consult Bardeen, C. W., 'The History of Educational Journalism in the State of New York' (Syracuse 1893); 'Report of Commissioner of Education, U. S. Bureau of Education, 1910'; Severance, H. O., 'A Guide to the Current Periodicals and Serials' (1914).

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EDUCATIONAL TEST FOR SUFFRAGE. See ELECTORAL QUALIFICATIONS.

EDWARD, THE ELDER, king of England: b. about 870; d. Farndon, Northamptonshire, 925. He was a son of Alfred the Great, and succeeded his father in 901. Ethelwald, the son of his father's elder brother, claimed the crown; and an insurrection took place in his favor, but it ended with the death of Ethelwald in battle. The reign of Edward was further distinguished by successes over the Anglicized and foreign Danes. He fortified many inland towns, acquired dominion over Northumbria and East Anglia, and subdued several of the Welsh tribes. Consult Oman, 'England before the Norman Conquest' (London 1910).

EDWARD (surnamed the "MARTYR"), king of England: b. about 963; d. Corfe Castle, 18 March 979. He was a son of Edgar, and succeeded his father in 975. His stepmother, Elfrida, wished to raise her own son, Ethelred, to the throne, but was opposed by Dunstan, through whose exertions Edward was peaceably crowned. His short reign was chiefly distinguished by the disputes between Dunstan and the foreign monks on one side, and the secular clergy on the other. Hunting one day in Dorsetshire he was separated from his attendants, and repaired to Corfe Castle, where Elfrida resided. He requested a glass of liquor, and as he was drinking on horseback one of Elfrida's servants gave him a deep stab behind. He immediately set spurs to his horse, but, fainting from loss of blood, was dragged in the stirrup until he died. The pity caused by his innocence and misfortune induced the people to regard him as a martyr.

EDWARD (surnamed the "CONFESSOR"), king of England: b. Islip, Oxfordshire, about 1004; d. 5 Jan. 1066. He was an elder son of Ethelred the Unready. On the death of his maternal brother, Hardicanute the Dane, in 1041, he was called to the throne, and thus renewed the Saxon line. He was not the immediate heir, as his brother, Edmund Ironside, had left sons; but as he received the support of Godwin, earl of Kent, on condition of marrying his daughter, Editha, his claim was established. Edward was a mild and virtuous prince, who acquired the love of his subjects by his sanctity and care in the administration of justice. It was under his reign that Westminster Abbey was built. Having been educated in Normandy, he introduced so many natives of that country to his court that the French language and manners became prevalent in England, to the great disgust of Earl Godwin and his sons. A rebellion took place, and Edward was forced to dismiss his foreign favorites. Perceiving that the youth and weakness of his chosen heir, Edgar Atheling (q.v.), would not secure the succession against the power and ability of Harold, the son of Godwin, he turned his eyes upon his kinsman, William of Normandy, in whose favor it has been asserted that he executed a will. He died leaving the point of the succession undetermined; and with him ended the Saxon line of kings. He caused a body of laws to be compiled from those of Ethelbert, Ina, and Alfred, which is the supposed source of the common law of England. He was canonized by Alexander III in 1166. Consult Hodgkin, 'History of England to 1066' (London 1906).

EDWARD I, king of England: b. Westminster 17 or 18 June 1239; d. Burgh-on-Sands, near Carlisle, England, 7 July 1307. He was a son of Henry III (his mother being Eleanor of Provence, the wife of Henry), and the contests between his father and the barons called him early into active life. In 1252 he became Lord of Gascony, and after his marriage to Eleanor of Castile in 1254, his father made him ruler of Ireland and Wales, and the towns of Bristol, Stanford and Grantham. The officials whom he appointed in Wales were resented by the inhabitants who revolted with the Scotch. Further discontent was manifested by the barons who were likewise indignant at the favors granted to foreigners. King Henry and Edward were finally forced to consent to the Provisions of Oxford which limited the royal power in regard to such appointments and war was declared in 1263. Edward finally quelled all resistance to the royal authority by the decisive defeat of Leicester, at the battle of Evesham, in 1265. In 1268 he joined the Crusade to Palestine, where he inspired so much terror that an assassin was employed to despatch him, from whom he received a wound in the arm. In 1271 he set out toward England, stopping at France to acknowledge his homage to Philip III for his French possessions. He was crowned King of England with Eleanor on 19 Aug. 1274. On assuming the government he acted with great vigor in the repression of the lawlessness of the nobles and the corruption in the administration of justice; but often evinced an arbitrary and grasping disposition. In 1274, and again in 1276, he summoned Llewellyn, prince of Wales, to do him homage, and upon his refusal, except on certain conditions, began the war which ended in the annexation of that principality to the English crown in 1283. Edward then spent some time abroad in mediating a peace between the crowns of France and Aragon, and on his return commenced his attempts to destroy the independence of Scotland. After his return from the Scottish expedition, in 1296, which terminated in the capture of Baliol, he became involved in a quarrel with his clergy, who, supported by the Pope, refused to submit to a tax which he had imposed upon them. Edward forced their compliance by placing them out of the protection of the law. His frequent expe-

dients to raise money at length produced great discontent among the nobles and people also, which obliged him to confirm the great charter and charter of forests, and also to give other securities in favor of public liberty. He then made a campaign in Flanders against France, which terminated with the recovery of Guienne and his second marriage with Margaret, the sister of King Philip. Meantime new commotions took place in Scotland under the guidance of the celebrated William Wallace. These transactions recalled Edward from Flanders, who hastened to the border with an army of 100,000 men. The ignominious execution of the brave Wallace, in 1305, as a traitor, forms a blot in the history of Edward. Neither did it avail, since Robert Bruce was able, in 1306, to place himself at the head of a new confederacy. Indignant at this determined spirit of resistance Edward vowed revenge against the whole Scottish nation, and, assembling another army, was on the point of passing the border when he was arrested by sickness and death. Few princes have exhibited more vigor in action, or policy in council, than Edward I. His enterprises were directed to permanent advantages rather than to mere personal ambition and temporary splendor. Nor was he less intent upon the internal improvement of his kingdom than its external importance. The laws of the realm obtained so much additional order and precision during his reign that he has been called the "English Justinian." He passed an act of mortmain, protected and encouraged commerce, and in his reign first originated the society of merchant adventurers. The manners of this able sovereign were courteous, and his person majestic, although the disproportionate length of his legs gave him the popular surname of "Longshanks." He left a son and three daughters by his first wife, Eleanor, who died in 1290, and two sons by his second wife, Margaret of France. Consult Stubbs, 'The Early Plantagenets' (1877); Tout, 'Edward I' (1893); Jenks, 'Edward Plantagenet' (New York 1902).

EDWARD II, king of England: b. Carnarvon Castle in 1284; d. Berkeley Castle, 21 Sept. 1327. He was the first English Prince of Wales and succeeded his father, Edward I, in 1307. He was of an agreeable figure and mild disposition, but indolent and fond of pleasure. His first step was to recall Piers de Gaveston, a young Gascon, whom his father had banished, and whom he created Earl of Cornwall, and married to his niece. He then went to France to espouse the Princess Isabella, to whom he had been contracted by his father, leaving Gaveston guardian of the realm. Soon after his return the barons associated against the favorite, whom they more than once obliged the king to send away. He was, however, as constantly recalled when the immediate danger was over, until an open rebellion took place, and Gaveston was captured and executed as a public enemy. In 1314 Edward assembled an immense army to check the progress of Robert Bruce, but was completely defeated at Bannockburn. After the death of Gaveston he selected another favorite, Hugh le Despenser, upon whom he lavished favors of every kind, until the barons again rebelled, and the Parliament doomed Despenser and his father to exile. The king was obliged to confirm the sentence. Edward, however, on this occasion, in concert with the Despensers, contrived to raise troops and attack the barons, at the head of whom was his cousin, the Earl of Lancaster, who, being taken prisoner, was executed at Pomfret. Edward subsequently made another fruitless attempt against Scotland, which ended in the conclusion of a truce of 13 years. In 1324 Queen Isabella went to France, and while there entered into a correspondence with several English fugitives, in whose hatred to the Despensers she participated. Among these was Roger Mortimer, a young baron of the Welsh marshes, between whom and Isabella a criminal intercourse followed, in consequence of which the queen was still more determined upon the ruin of her weak and unhappy husband. Having formed an association with all the English malcontents, and aided with a force by the Count of Hainault, she embarked for England in September 1326, and landed in Suffolk. Her forces seized the Tower of London and other fortresses, captured and executed both the Despensers without trial, and at length took the king prisoner. Edward was confined in Kenilworth Castle, and in January 1327 his deposition was unanimously voted in Parliament, on the ground of incapacity and misgovernment. A resignation of the Crown was soon after extorted of him, and he was transferred to Berkeley Castle, where Mortimer dispatched two ruffians, who murdered him, in the 20th year of his reign and 43d year of his age. Consult Vickers, 'History of England, 1272–1485' (London 1912).

EDWARD II, an historical tragedy by Christopher Marlowe (1598). It follows history closely in its main lines and is a powerful representation of the tragic history of that king.

EDWARD III, king of England: b. Windsor, 13 Nov. 1312; d. Richmond, Surrey, 21 June 1377. He was a son of Edward II, and on his father's deposition in 1327, was proclaimed king under council of regency, while his mother's paramour, Mortimer, really possessed the principal power in the state. The pride and oppression of Mortimer now became so intolerable that a general confederacy was formed against him. The result was the seizure of Mortimer, who was tried and condemned by a parliament at Westminster, and was executed 29 Nov. 1330. The queen, although treated with outward respect, never again during the remaining 28 years of her life recovered any degree of authority. Edward now turned his attention to Scotland. Assisted by some principal English nobles, Edward Baliol, son of the John Baliol to whom the crown had been awarded by Edward I, raised a force, and defeating the Scots in a great battle, set aside David Bruce, then a minor, and was crowned at Scone in 1332. Baliol being driven away on the departure of his English auxiliaries, applied to Edward, who defeated the regent, Douglas, at the famous battle of Halidon Hill, in July 1333. This victory produced the restoration of Baliol, who was, however, again expelled, and again restored, until the ambition of Edward was called off by a still more splendid object. The crown of France, by the Salic law, having devolved to Philip de Valois, cousin-german to the deceased king Charles the Fair, Edward was induced to claim it in right of his mother,

that monarch's sister. Edward, in order to obtain supplies, made concessions to Parliament which he never intended to keep; and finding his territory of Guienne threatened, sent over a force for its defense, and quickly followed himself, accompanied by his son Edward, the famous Black Prince, all his chief nobility, and 30,000 men. The memorable battle of Crécy followed, 25 Aug. 1346, succeeded by the siege of Calais. In the meantime, David Bruce, having recovered the throne of Scotland, made an incursion, at the head of a large army, into England; but being met at Durham by a much inferior force, raised by Queen Philippa, and headed by Lord Percy, was totally defeated and taken prisoner, with many of his principal nobles. Philippa went over to her husband at Calais, and, by her interference prevented the barbarous execution of Eustache de Saint Pierre and five other citizens, whom Edward, on the capitulation of the place, had determined to execute, in revenge for his long detention in the siege. In 1348 a truce was concluded with France. The year 1349 was distinguished by the institution of the order of the Garter, which soon became one of the most illustrious orders of knighthood in Europe. Philip, King of France, dying in 1350, was succeeded by his son John, the commencement of whose reign abounded with intestine commotion, and in 1355 Edward again invaded France on the side of Calais, while the Black Prince at the same time led a large army from Gascony. Both these expeditions were attended with much plunder and devastation; and Edward, being recalled home by a Scottish inroad, soon repelled it, and retaliated by carrying fire and sword from Berwick to Edinburgh. During this time the Prince of Wales had penetrated from Guienne to the heart of France, where he was opposed by King John, at the head of an army nearly five times more numerous than that of the English. The famous battle of Poitiers ensued, in which the French monarch was taken prisoner. Edward held at the same time in captivity the kings of France and Scotland, the most dangerous of his enemies. John was taken to England and treated with the greatest respect; and David was soon after liberated upon ransom. A truce had been made with France after the battle of Poitiers, at the expiration of which, in 1359, Edward once more passed over to Calais with a large army, but at length consented to a peace. Besides the stipulation of a large ransom for King John, several provinces and districts in the southwest of France and neighborhood of Calais were yielded to Edward, who in turn resigned his title to the crown of France and duchy of Normandy. Quarrels with his Parliament, the opposition of the Black Prince and personal affairs dissipated the rest of his reign. The successor of John, Charles V, invaded the provinces entrusted to Prince Edward, and Edward had the mortification of witnessing the gradual loss of all his French possessions, except Bordeaux and Bayonne, and of all his conquests except Calais. Consult Longman, 'Life and Times of Edward III' (1869); Mackinnon, 'History of Edward III' (1900); Vickers, 'History of England, 1272–1485' (London 1912).

EDWARD IV, king of England: b. Rouen, France, 29 April 1441; d. 9 April 1483. His father, Richard, Duke of York, was grandson of Edward, Earl of Cambridge, and Duke of York, fourth son of Edward III, while the Lancaster branch descended from John of Gaunt, the third son. The York line had intermarried with the female descendants of Lionel, the second son, which gave it the preferable right to the crown. Edward, on the defeat and death of his father at the battle of Wakefield, assumed his title, and having entered London after his victory over the Lancastrians at Mortimer's Cross in February 1461 was declared king by acclamation. Soon after his accession he had to fight for his crown against an army of 60,000 Lancastrians, assembled in Yorkshire; and the field of Towton confirmed his title by a decisive victory. Although the high-spirited Margaret was enabled by the aid of Louis XI of France again to take the field, the result of the battle of Hexham, in May 1464, obliged her to return to Flanders, and leave her husband, the imbecile Henry VI, a prisoner in the hands of his enemies. By a marriage with Elizabeth Woodville, widow of Sir John Grey of Groby, a Lancastrian, Edward plunged himself into very serious difficulties, since at the same time he had despatched the Earl of Warwick to negotiate a marriage for him with Bona, sister to the Queen of France; so that he at once offended two royal houses and his powerful friend Warwick. Aided by France, Warwick, who had contracted his daughter to the Lancastrian Prince Edward, landed with Clarence and some other lords at Dartmouth; and quickly saw himself at the head of 60,000 men, with whom he marched to encounter Edward. The king left Warwick in full possession of his kingdom, 11 days after he had set his foot in it. Henry's title was again recognized by Parliament, and Warwick and Clarence were declared regents of the kingdom. Edward subsequently landed at Ravenspur, in Yorkshire. Here his forces were reinforced by partisans from all quarters, and he was soon enabled to march to London, where he obtained entrance as king, and the unfortunate Henry again became prisoner. Warwick advanced against him as far as Barnet, where, on 4 April 1471, another great battle was fought, which ended in the death of Warwick, and a decisive victory on the part of Edward. On the same day Queen Margaret and her son landed at Weymouth, and marched into Gloucestershire, where she was met by the victorious Edward, who totally defeated her at Tewkesbury. The story is told that the queen and her son Edward being taken prisoners and brought into the presence of the victor, Edward asked the latter how he dared to invade his dominions. On receiving a spirited answer he basely struck the captive prince on the face with his gauntlet — the signal for immediate massacre by the king's brothers and other nobles attendant. Margaret was thrown into the Tower, where Henry VI soon after died, but whether by violence or by disease is uncertain. The latter part of his reign was disturbed by his jealousy of his brother Clarence, whom he put to death, it is said, by drowning in a butt of Malmsey wine. He had ten children, seven of whom survived him. His reign was marked also by commercial enterprise, notably the introduction of printing and silk manufactures; and by prog-

ress in legal methods, especially in the adoption of indirect pleading. Consult Ramsay, 'Lancaster and York' (2 vols., Oxford 1892); Vickers, 'History of England 1272–1485' (London 1912).

EDWARD V, king of England: b. Westminster, 2 or 3 Nov. 1470; d. London 1483. He was the eldest son of Edward IV, and was in his 13th year when he succeeded his father in 1483. He fell into the hands of his uncle, the Duke of Gloucester, the regent who caused the young king and his brother to be sent to the Tower, and, it is said, had them smothered by ruffians. Two bodies, answering their description, were found buried at the foot of the stairs of their apartment in the reign of Charles II and were taken up by that king's order, and deposited in Westminster Abbey.

EDWARD VI, king of England: b. Hampton Court, England, 12 Oct. 1537; d. Greenwich, 6 July 1553. He was the son of Henry VIII by Jane Seymour. At his father's death he was only 10 years of age, and as he did not live to attain majority, the public acts of his reign are to be deemed those of his counsellors. His education was entrusted to men of the first character for learning, among whom was Sir John Cheke. He was studious, somewhat retiring, devout, and showed a decided preference for the reformed doctrines, and antipathy to those of the Roman Catholic Church. Protestantism made rapid advances in the kingdom. The churches were divested of images, Henry's 'Bloody Statute' was repealed; Crammer and Ridley were ordered to prepare a new service book which was authorized for use in the kingdom. After his father's death his maternal uncle, the Duke of Somerset, became protector. He sent forces against Scotland under Seymour to punish that government for its refusal to consent to the marriage of Mary Queen of Scots to Edward. The Scots were defeated at Pinkie, 1547. Somerset's administration raised up such powerful enemies, among them John Dudley, Earl of Warwick, that he was brought to the scaffold with the king's consent (1552). After his death, Dudley, who had been created Duke of Northumberland, became all-powerful, and through his influence Edward, in a declining state of health, was induced to set aside the succession of both his sisters, and to settle the crown upon Lady Jane Grey, claiming through his father's youngest sister, the Duchess of Suffolk. Edward's principal benefit to the kingdom was in the restoration of the grammar schools. Consult Innes, 'England under the Tudors' (London 1905).

EDWARD VII (ALBERT EDWARD), King of Great Britain and Ireland and Emperor of India: b. Buckingham Palace, 9 Nov. 1841; d. 6 May 1910. He was the eldest son and the second child of Queen Victoria and the prince consort, Prince Albert of Saxe-Coburg. After receiving a careful education under private tutors he studied at the universities of Edinburgh, Oxford, and Cambridge. In the summer of 1860 he visited Canada, where he was enthusiastically received and by special invitation of President Buchanan extended his visit to the United States, where his reception was no less cordial. He was appointed a brevet-colonel in the army in 1858 and three years later was attached to the Curragh Camp in Ireland. In October 1861 he was made a bencher of the Middle Temple. In 1862 he was promoted to the rank of general and in the spring of that year he set out on a visit to Egypt, Palestine, Syria and Athens. After the Prince's return from the East he was introduced at the privy council, in 1863 he took his seat in the House of Lords and about the same time formally gave up his right to succeed to the Duchy of Saxe-Coburg-Gotha. On 10 March 1863, at Saint George's Chapel, Windsor Castle, he was married to the Princess Alexandra, eldest daughter of the King of Denmark. Near the end of 1871 he was attacked by typhoid fever and for a time it seemed as if his death were imminent. In 1875–76 he made a tour in India and was everywhere received with the utmost cordiality and respect. With the Princess he made an extended tour through Ireland in 1885. The establishment of the Imperial Institute as a memorial of the jubilee of Queen Victoria (1887) was mainly due to his suggestion and exertions. In 1893 he sat on the Poor Law Commission. In the diamond jubilee year (1897) he established the Prince of Wales Hospital Fund for the better financial support of the London hospitals. By the death of his mother on 22 Jan. 1901, he became King of Great Britain and Ireland and Emperor of India and elected to be known as Edward VII.

Elaborate national and international preparations for the coronation ceremonies in Westminster Abbey were made for 26 June 1902; but owing to sudden illness these had to be postponed and were carried through in a modified form on 9 August.

The new king thus came to the throne in his sixtieth year. He found foreign opinion alienated by the Boer War and he set himself strenuously to promote international amity. In some measure at least the growing friendliness between his country and France and Russia was due to his efforts to promote good will and in his last years he viewed with deep concern the coolness that was springing up with Germany. Owing to his close family kinship with most of the crowned heads in the Old World, French wits styled him the "uncle of Europe." Brought up on a very narrow system of education in which even the perusal of Sir Walter Scott's novels was banned, he never acquired a taste for reading, but possessed uncommon natural powers of observation. Denied intercourse with boys of his own age and disciplined with a spartan severity, it was only natural that when manhood and freedom came he should travel far from the rigid traditions in which he had been reared. The breath of scandal did not leave him unscathed, but his charm of manner, his frankness of disposition and his punctilious discharge of the somewhat formal duties that fell to him as Prince of Wales endeared him to the British public. During the long years of Queen Victoria's widowhood, her growing isolation from public life made of her throne a "lonely splendor," and the state of tutelage in which she kept the heir-apparent, denying him access to confidential documents, prevented him from developing any aptitude for affairs of state. When he came to the throne he revived in a very real sense the ceremonial splendors of the monarchy; he was fond of pagentry and the observances associated with

the stately ordering of court functions, and during his brief reign he completely won the hearts of his people and the respect of the civilized world. His last years were clouded by the feud between Lords and Commons over the rejection by the former of the Budget of 1909 and his unexpected death (6 May 1910), due to heart failure supervening on an attack of bronchitis, evoked a wave of sympathy that was world-wide. He had an ideal consort in Queen Alexandra, who performed the duties of her high station with a grace, sympathy and tact that won her a special place in the hearts of the British public. Consult Sir Sidney Lee's contribution to Vol. I of the second supplement to the 'Dictionary of National Biography' (1912); also Legge's 'King Edward in His True Colours' (1912). To King Edward and Queen Alexandra were born Albert Victor Christian Edward, Duke of Clarence and Avondale, b. 8 Jan. 1864; d. 14 Jan. 1892; George Frederick Ernest Albert, who succeeded to the throne, b. 3 June 1865, married 6 July 1893, to the Princess Victoria Mary of Teck; Princess Louise Victoria Alexandra Dagmar, b. 20 Feb. 1867, married 27 July 1889, to the Duke of Fife; Princess Victoria Alexandra Olga Mary, b. 6 July 1868; and Princess Maud Charlotte Mary Victoria, b. 26 Nov. 1869, married 22 July 1896, to Prince Charles of Denmark, now King Haakon VII of Norway.

EDWARD, Prince of Wales, surnamed the Black Prince, English prince: b. Woodstock, 15 June 1330; d. Westminster, 8 June 1376. He was the eldest son of Edward III and Philippa of Hainault, and at the age of 15 accompanied his father in his invasion of France, and received from him the honor of knighthood. The victory of Crécy, 26 Aug. 1346, which King Edward left principally to the exertions of the force under his son's command, to use that warlike king's language, "showed that he merited his spurs." It was on this occasion that he assumed the motto of *Ich dien* (I serve), used by all succeeding princes of Wales, and derived, it is said, from the crest of the King of Bohemia, slain in that battle, which tradition, however, later antiquaries seem disposed to discredit. In 1335 he commanded the army which invaded France from Gascony, and the next year fought the great battle of Poitiers, and distinguished himself by the courtesy with which he treated his prisoner, King John. By the Peace of Bretigny his father had obtained the provinces of Poitou, Saintonge, Périgord, Limousin, etc., which he annexed to Guienne and formed into a sovereignty for his son, under the title of the Principality of Aquitaine. There the prince took up his residence; and at his court Pedro the Cruel, the deposed king of Castile, sought refuge, when driven from his throne by his natural brother, Henry of Trastamare. Edward undertook the re-establishment of this tyrant, which he accomplished. Disappointed by the perfidy of Pedro, of the stipulated reimbursements, the taxes he was obliged to levy on his new subjects rendered his government unpopular; and an appeal was made to the king of France, as his liege lord, who summoned him as his vassal to appear at Paris. "I will come," replied the angry prince, "but it shall be at the head of 60,000 men." His health, however, was too far declined to enable him to take the field, when the king of France invaded his dominions; and having suffered the mortification of seeing his generals defeated, he withdrew into England, and after lingering some time died in his 46th year, leaving an only son, afterward Richard II. He was buried in Canterbury Cathedral, where portions of his armor are still suspended above his tomb. Consult Dunn-Pattison, 'The Black Prince' (London 1910); Vickers, 'History of England 1272–1485' (ib. 1912).

EDWARD, Thomas, Scottish naturalist: b. Grosport, 1814; d. 27 April 1886. As the apprentice of a shoemaker he spent the early part of his life in Aberdeen, and in 1837 married and settled in Banff. Here he struggled for 40 years in a ceaseless effort to acquire a close knowledge of natural history, while at the same time he supported his wife and 11 children on wages that never exceeded 15 shillings a week. Apart from his laborious work as a shoemaker he collected, described and exhibited numerous specimens of natural history notably of birds and of crustacea. In 1866 he was elected an associate of the Linnaean Society of London. A biography of Edward, written by Samuel Smiles (q.v.), appeared in 1876, 'Life of a Scotch Naturalist,' and being thus prominently brought before the public, a pension of £50 a year was conferred upon him by the queen.

EDWARDES, Sir Herbert Benjamin, British soldier and administrator: b. Frodesley, Shropshire, 1819; d. 1868. He received his education at King's College, London, and entered the Indian army in 1840. He served on the staff of Sir Hugh Gough in the First Sikh War in 1845–46 and in 1847 became first assistant to Sir Henry Lawrence, the British resident at Lahore. In 1848 he suppressed an uprising in Mooltan and for his services received the thanks of Parliament and was brevetted major. He rendered splendid services during the Indian Mutiny of 1857 by securing the neutrality of Afghanistan, thus permitting troops to be withdrawn from the northwest border and rushed to the relief of Delhi and Lucknow. Because of failing health he was obliged to decline the governorship of the Punjab, tendered him in 1862, and to return to England. He was promoted a major-general a short time before his death. Banu, Punjab, was renamed in his honor, Edwardesabad.

EDWARDS, Amelia Blandford, English Egyptologist and novelist: b. London, 1831; d. Weston-super-Mare, Somerset, 15 April 1892. Her novels include 'My Brother's Wife' (1855); 'Hand and Glove' (1859); 'Half a Million of Money' (1865); 'Lord Brackenbury' (1880); 'Barbara's History,' and 'In the Days of My Youth' (1873). Later she achieved great celebrity through her writings and lectures in Europe and the United States on the antiquities of Egypt; her best-known works in this field are 'A Thousand Miles Up the Nile' (1877); and 'Pharaohs, Fellahs and Explorers' (1891). She also translated Maspero's work on 'Egyptian Archæology,' and was secretary of the Egyptian Exploration Fund.

EDWARDS, Arthur, American clergyman and editor: b. Norwalk, 1834; d. 1901. In 1858 he was graduated at Ohio Wesleyan University and in the same year entered the ministry of

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the Methodist Church. In the Civil War he served as chaplain of the First Michigan Infantry until after the battle of Gettysburg. In the following year he was made assistant editor of the *Northwestern Christian Advocate* of Chicago and from 1872 until his death he was editor. He attended seven general conferences of his Church and the ecumenical Methodist conference at London in 1881, before which he read a paper on 'The Status of Methodism in the Western Hemisphere.' In 1876 he was a member of the committee which revised the Church hymnal. He also served as secretary of the Detroit Conference for about 12 years. At the general conference of 1868 he edited the *Daily Christian Advocate*.

EDWARDS, Bryan, English historian of the West Indies: b. Westbury, Wiltshire, 21 May 1743; d. Southampton, 15 July 1800. On the death of his father he was taken under the care of an uncle in Jamaica, who left him a large fortune. After a successful mercantile career he returned to England, and in 1796 took his seat for the borough of Grampound, which he represented until his death. He is remembered for his 'History, Civil and Commercial, of the British Colonies in the West Indies' (1793). A new edition of this work (1801) includes a history of San Domingo. He also published 'Proceedings of the Governor and Assembly of Jamaica in regard to the Maroon Negroes' (1796).

EDWARDS, Charles Lincoln, American scientist: b. Oquawka, Ill., 8 Dec. 1863. He was graduated at Lombard University in 1884; Indiana University, 1886; and the University of Leipzig 1890. He was fellow of biology in Clark University, 1892–93; associate professor of biology in the University of Texas, 1893–94; professor of biology in the University of Cincinnati, 1894–1900; professor of natural history in Trinity College, 1900–10; and associate professor of biology in the University of Southern California, 1911–12; professor of embryology and histology, medical department, University of Southern California, 1912–13; director of nature-study, Los Angeles city schools after 1912. He was president of the American Folk-Lore Society in 1899. He has published 'Bahama Songs and Stories' (1895), and many papers and monographs on subjects in biology, embryology, folk-lore, etc.

EDWARDS, Clarence Ransom, American military officer: b. Cleveland, Ohio, 1 Jan. 1860. He was graduated at West Point in 1883; professor of military science and tactics at Saint John's College, Fordham, 1890–93; commissioned first lieutenant, 1891; captain, 1898; lieutenant-colonel of volunteers, 1899; served on the staff of General Lawton in the Philippines, and was recommended for brevets of major, lieutenant-colonel, and colonel in the regular establishment, and brigadier-general of volunteers; accompanied General Lawton's body to the United States; chief of the division of insular affairs. War Department, 1900–02; commissioned colonel, 1 July 1902, and chief of the bureau of insular affairs and director of its publications, until 1912. He became brigadier-general 30 June 1906; transferred to line in 1912, and later commanded the Sixth Brigade, Second Division at Texas City, Tex., and the First Hawaiian Brigade at Honolulu, H. I. In 1915 he was placed in command of the troops in the Panama Canal Zone.

EDWARDS, George Wharton, American artist and author: b. Fairhaven, Conn., 1859. He was educated in Antwerp and Paris, and has received many medals and honors for his work at American and European exhibitions. His watercolors are particularly praiseworthy and his magazine illustration is well known and of a high quality. He has published 'Thumbnail Sketches' (1886); 'P'tit Matinic and Other Monotones' (1887); 'The Rivalries of Long and Short Codiac' (1888); 'Break o' Day, and Other Stories' (1889); 'Holland of Today' (1910); 'Reading Journey in the Hollow Land, Chautauqua' (1910); 'Brittany and the Bretons' (1911); 'Marken and its People' (1912); 'Some Old Flemish Towns' (1913); 'The Forest of Arden' (1914); he has illustrated Oliver Wendell Holmes' 'Last Leaf' (1885); Austin Dobson's 'Sun Dial' (1892); Spenser's 'Epithalamion' (1895); 'Old English Love-Songs' (1896); 'Old English Ballads' (1897); 'Hans Brinker and the Silver Skates' (1915). He is a member of The American Society Water Color Painters; New York Water Color Club; The Authors Club, and the Society of Arts. He painted the mural decoration 'Henry Hudson' in the West Point Military Academy.

EDWARDS, Harry Stilwell, American journalist and novelist: b. Macon, Ga., 23 April 1855. He was graduated from the law department of Mercer University but in 1881 entered journalism in his native city. He is well known as a writer of magazine stories most of which relate to life in the South, and of numerous songs and poems. Among his works are 'Two Runaways and other Stories' (1889); 'His Defense and other Stories'; 'Sons and Fathers' a novel that won a prize of $10,000 in a world-wide contest over 800 manuscripts; and 'The Marbeau Cousins.' His lullaby song 'Mammy's Little Boy' and poem 'The Vulture,' have a more than national reputation. In 1904 at Chicago he seconded the nomination of Theodore Roosevelt in a notably eloquent oration. He was referee in Georgia for the seven years of Roosevelt's administration and served as postmaster at Macon, Ga., for 13 years, to which office he was appointed first by President McKinley. He is a member of the National Institute of Arts and Letters.

EDWARDS, Henri Milne-. See MILNE-EDWARDS.

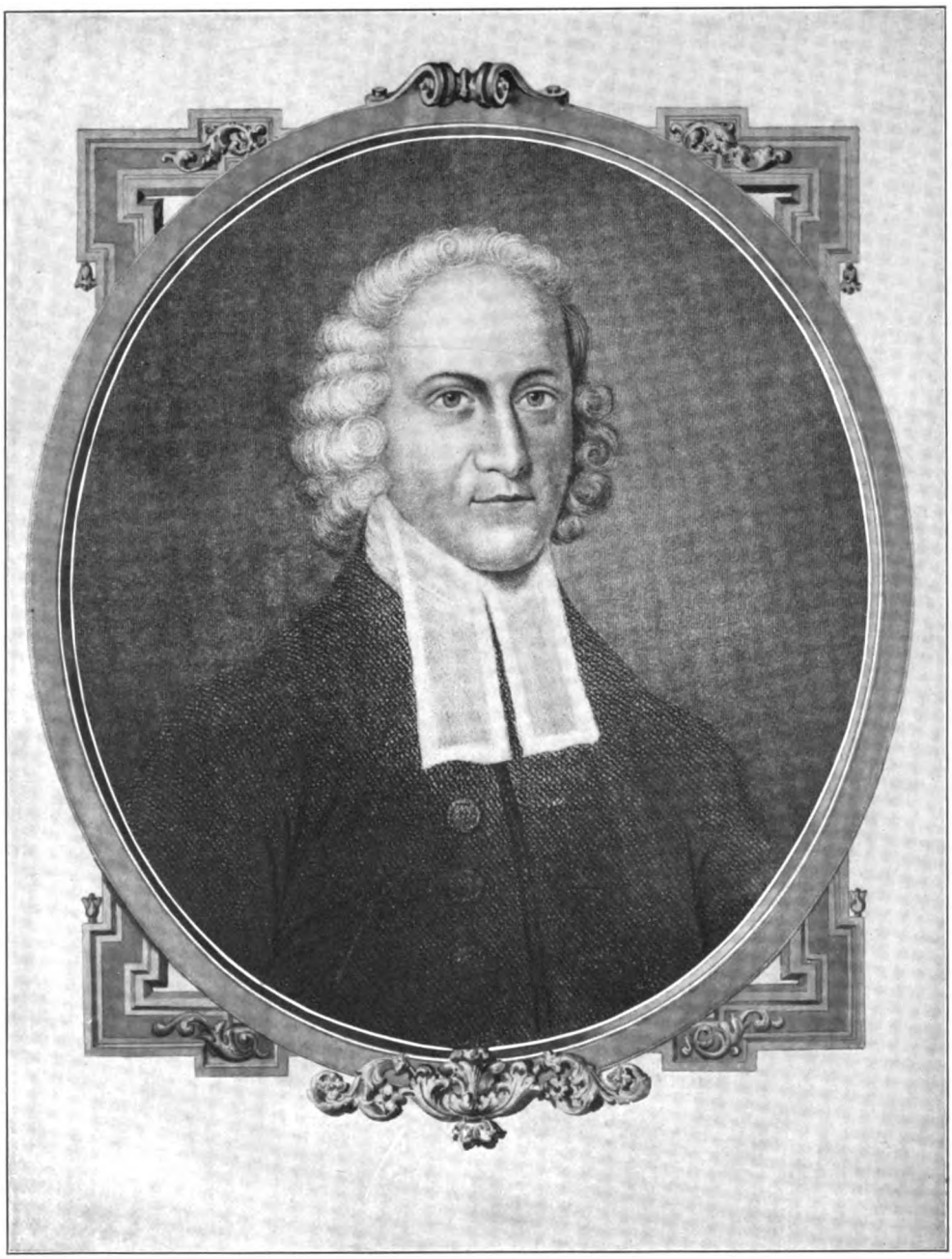
EDWARDS, James Corson, American poet: b. Philadelphia, Pa., 17 July 1802; d. Macon, Ga., April 1861. He moved to Georgia in 1821, and was a poet at one time extensively quoted in the South; author of 'An Ode To Music' and much verse preserved chiefly in southern school readers; also of many campaign songs in Whig circles.

EDWARDS, James Thomas, American educator: b. Barnegat, N. J., 6 Jan. 1838; d. Randolph, N. Y., 20 Aug. 1914. He was graduated at Wesleyan University in 1860. He served in the National army in the Civil War, was afterward principal of several schools, and in 1892–93 was field-secretary of the Chautauqua System of Education. He was a senator in the Rhode Island legislature, 1865–69, and a mem-

ber of the New York legislature, 1892–93; was chairman of the committee on education of both bodies, and was the author of the University bill and Library and Traveling Library bills. He was a trustee and director of the departments of physics and chemistry of the Chautauqua summer schools 1883–93, and was prominently identified with other educational movements. He published 'The Grass Family' (1872); 'The Silva of Chautauqua Lake' (1892); 'Addresses — Educational, Political, Scientific, Religious' (1896); 'Pen and Picture' (1896); 'Rhymes from a Reclining Chair' (1902); 'The Edwards Family' (1903); and articles to various periodicals.

EDWARDS, John Passmore, English newspaper proprietor: b. Blackwater, Cornwall, 24 March 1823; d. Hampstead, 22 April 1911. The son of a carpenter, he began life as a publisher's clerk, became absorbed in public questions, and was a delegate to peace conferences at Brussels, Paris and Frankfort, 1848–50. His early publishing ventures were failures; but success came to him after he acquired in 1876 the London *Echo*, the first halfpenny evening journal in London, which he edited with marked ability for 20 years, and kept "clean" of all doubtful matter and betting news. He represented Salisbury as a Liberal 1880–85, but seceded from Mr. Gladstone on the Home Rule issue, and retired from politics. He showed a wise discrimination as well as generosity in the use of his wealth, and founded upwards of 70 public institutions, including libraries. His autobiography was privately printed in 1905, under the title 'A Few Footprints.'

EDWARDS, Jonathan, American theologian: b. in South (then East) Windsor, Conn., 5 Oct. 1703; d. Princeton, N. J., 22 March 1758. His father, the Rev. Timothy Edwards, a graduate of Harvard, was parish minister at Windsor for nearly 60 years. His mother, Esther Stoddard, a daughter of the Rev. Solomon Stoddard, minister in Northampton, Mass., is celebrated for force of character and native vigor of intelligence. There were 10 other children in the family, all girls. Jonathan, the fifth child, was brought up with his sisters in an environment peculiarly adapted to his development. The quiet beauty of the landscape about Windsor and the outward simplicity of the life in the village and the home, where the interests of recognized supremacy were those of the spirit and the mind, exerted congenial influence on a character pre-eminently disposed to reflection and to the feeling and practical acknowledgment of things invisible. Religion, both in its experimental and in its theoretical aspects, early became his absorbing preoccupation. The precocity of his intellectual development is shown in his first essays, a metaphysical tract on the nature of the soul, written when he was 10, and a paper, remarkable for accuracy of observation and acuteness and breadth of reasoning, on the habits of the "flying spider," written some two years later. At 13 he entered the Collegiate School at Saybrook, afterward Yale College, from which he graduated at New Haven, with the valedictory in a class of 10, shortly before his 17th birthday (1720). The event of greatest intellectual significance for Edwards, and one which may even be said to mark a turning-point in the history of philosophy in America, was his reading, in his sophomore year in college, of Locke's 'Essay on the Human Understanding.' The book made on him a profound impression. He read it, he tells us, with a pleasure far higher than that of the greediest miser gathering up handfuls of silver and gold from some newly discovered treasure. He began now, or shortly afterward, a series of notes designed as material for an exhaustive treatise on the mind. He also wrote a series of notes with a view to a corresponding treatise on natural science. These notes, some of which probably belong to the years immediately following his graduation, though some of the most important almost certainly go back to an earlier date, throw a flood of light on the whole subsequent development of his thinking, as well as on the character and workings of his mind at the period of their composition. The notes on natural science, indeed, valuable as they are as evidence of his genius, express in their main contents only an incident in his thinking. But the psychology and philosophy of both series of notes, especially the notes on the mind, are intimately connected with his theological interests. Here the influence of Locke is marked, but more striking still the originality of the writer's response to it. Edwards accepts Locke's empiricism only in part. He makes all our ideas "begin from" sensation; he recognizes distinctly the fundamental importance of the mechanism of association and the part played by "images" in the higher intellectual processes. But he is very far from regarding mind as constituted of passively received impressions and their copies. He emphasizes rather the intellectualistic elements in Locke's doctrine; his tendency is toward Kant rather than toward Hume. The mind is, in his view, essentially active, in pleasure and pain, in sentiment and emotion, as well as in judgment and choice. In its intellectual constructions, moreover, the mind is guided by intuitively certain principles (being, cause, finality, etc.) and is capable, by reflection, of rising above all things sensible to the contemplation of things spiritual and eternal. Universals are not all of pragmatic origin and merely nominal import; the most considerable species have their foundation in "the order of the world." The most noteworthy metaphysical advance beyond Locke lies in the idealistic theory of matter. The general conception was not new; already in the 18th century, before the earliest of these notes were written, Norris, Collier and Berkeley had propounded similar views. Edwards may have heard of their writings, but it is doubtful if he had read any, and practically certain that he had not then read Berkeley. However suggested, the doctrine is worked out in a thoroughly independent fashion and the expression of it is wholly original; the true substance of the material universe is declared to be God and its *esse* not *percipi*, but an "infinitely exact and precise divine idea, together with an answerable, perfectly exact and stable Will, with respect to correspondent communications to created minds, and effects on their minds." In a later note in his diary he desires as clear a conception of the relation to God of finite minds. In one of the notes on the mind, he rejects Locke's notion that personal identity consists in identity of consciousness. The whole trend of his metaphysics pointed to another solution,



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With him the fundamental ontological verity is "that God and Real Existence are the same," "that God is" and that "there is none else." Created spirits are "emanations" or "communications" of his Being. What other conception then for him is possible, but that they, too, like material things, consist in God's distinguishing Thought and stable Will?

Edwards seems to have had no occasion to refer in his later writings to the idealistic theory of matter so pronounced in these notes of his youth. But there is no reason for thinking that he abandoned a view so congruous with his general philosophical position. Other of his most distinctive teachings are here already expressed or indicated. Here, for example, is the doctrine that the will, which is regarded as identical with inclination so far as the latter has respect to the mind's immediate actions, is always determined by motives inherent in the mind's apprehension of the greatest apparent good. Here, too, are the doctrines that "excellency" consists in "the consent of being to being"; that virtue, or the excellency of minds, consists in "love to being"; that the type of this excellency is God's mutual love of himself in the eternal process of the Trinity; that God's love to himself "includes in it, or rather is the same as, a love to everything, as they are all communications of himself"; and that, since God is "universal Being," true virtue in finite minds consists in love to him. These are the positions elaborated in the treatises on the 'Will' and on the 'Nature of True Virtue' and in the recently (1903) published essay on the 'Trinity.' And the most speculative of Edwards' works, the treatise on 'God's End in Creation,' is essentially but an application to a special problem of the conceptions here advanced concerning the nature of God as "universal Being" and as "Love," of finite spirits as "emanations," "communications" or "creations" in his likeness and of the sensible world as in its order and harmony, a "shadow" of his excellency.

Edwards then remained two years in New Haven studying for the ministry. He then preached for several months to a small Presbyterian church in New York. But he again returned to New Haven, took his master's degree, and for two years (1724–26) was tutor in the college. He had declined several invitations to a settlement in the ministry and seemed definitely committed to the academic career, for which by training and intellectual gifts he was eminently qualified, when the call came to him from the church in Northampton, Mass., to become the colleague of the venerable Solomon Stoddard, his grandfather. He was installed at Northampton, 15 Feb. 1727. A few months later he married Sarah Pierrepont, of New Haven, then 17, of whom four years before he had written an admiring description, celebrated as one of the most perfect and charming of its kind in literature.

The moral and religious development of Edwards up to this period was as remarkable for richness of experience and intensity of spiritual energy as was his intellectual development for originality, acuteness and speculative power. In a "narrative of personal experience," written for his own use, we have the intimate record of his religious life from its early beginnings, when as a boy he built with other boys a booth in a swamp for daily prayer and had other places for his own devotions besides, through its decline and revival — his "conversion," it has been called, though, as he notes with some misgiving in his diary, he was never converted in the manner traditionally expected — to its culmination in a state of settled conviction, with great inward delight in the truth and beauty of the objects of religious faith, including at times marked exaltation of sentiment and something akin to ecstasy. His diary, in which, after the fashion of the time, he watches, with almost morbid intensity, the daily fluctuations of his spiritual state, tells the same story for a part of the period. And in his 70 'Resolutions' we have a most striking expression of the lofty moral purposes of his life and of the ideas which actually governed it. For example: "To live with all my might while I do live"; "when I think of any theorem in divinity to be solved, immediately to do what I can toward solving it, if circumstances do not hinder"; "never, henceforward, till I die, to act as if I were any way my own, but entirely and altogether God's"; "on the supposition that there never was to be but one individual in the world, at any one time, who was properly a complete Christian, in all respects of a right stamp, having Christianity always shining in its true lustre, and appearing excellent and lovely, from whatever part and under whatever character viewed: resolved, to act just as I would do, if I strove with all my might to be that one, who should live in my time." It is the combination of this rare emotional susceptibility, this high reverence and moral enthusiasm, this strict, unrelaxing conscientiousness, with extraordinary subtlety and perspicacity of intellect and an unrivaled capacity for logical analysis and abstract reasoning that gives to Edwards his distinction and is the secret of his power.

On the death of Mr. Stoddard in 1729, Edwards, then 25, became sole pastor of the church in Northampton, which was reputed the largest and wealthiest in the colony outside of Boston. In 1731 he preached in the "public lecture" in Boston the sermon, "God Glorified in Man's Dependence," with which he achieved a notable success. The sermon is an eloquent and impressive proclamation of one of the most fundamental articles of his creed, the doctrine of God's "absolute sovereignty" in the work of salvation: it was a prophet's call to the Puritan churches to return to the old high Calvinistic faith. The counterpart to it is the sermon, published in 1734, on the 'Reality of Spiritual Light,' which proclaims the mystical principle of a supernatural illumination directly imparted and experienced. The emphasis on religious experience becomes still more pronounced in the two great revivals with which the fame of Edwards as a preacher is especially associated. He wrote the story of the earlier revival, that of 1735 in Northampton, in his 'Narrative of Surprising Conversions' (1736), with confident, even exultant, assurance; the excesses of the "Great Awakening" of 1740–42, more extensive and tumultuous, led him to reflect on the difference between a genuine and a false experience ('Distinguishing Marks of a Work of the Spirit of God,' 1741), and then to an apologetic defense of the movement against the objections of its opponents ('Thoughts on the Revival,' 1742). It was in the height of the excitement

that he preached in Enfield, Conn., his sermon on 'Sinners in the Hands of an Angry God' (1741), the extreme representative of a type not uncommon with him, indeed, yet not the most common nor the most representative even in his revival preaching (consult for example, the sermons 'Justification by Faith,' etc., 1738). More noteworthy and far more original was the treatise on the 'Religious Affections' (1746), in which the distinctively new note in Edwards, the new emphasis on subjective experience, receives its fullest systematic expression.

In the reaction which followed the revival, a case of discipline arose in his parish — many of the young people being charged with reading and circulating immoral books — the unfortunate management of which caused strong resentment and permanently undermined his influence. This was in 1744. Four years later, on his attempt to set aside the established custom — an extension of the old "Half-way Covenant" of which Mr. Stoddard had been the chief advocate — and require for full communion a credible profession of godliness, the disaffection became a bitter and determined opposition. The controversy ended finally in his dismissal, 22 June 1750, after a ministry of 23 years, perhaps the most laborious and distinguished in the annals of the American churches. His 'Farewell Sermon,' the greatest of his discourses, is a noble expression of his character and the dignified "apologia" of his ministerial life. Early in the following year he removed with his family to Stockbridge, Mass., then a settlement on the frontier, to do the double work of pastor of the village church and missionary to the Indians. It was while thus engaged that he wrote, during the seven years of his residence in Stockbridge, the theological treatises and essays which are the solid foundations of his fame. In the autumn of 1757 he accepted, with some misgivings, a call to the presidency of the college in Princeton, N. J., made vacant by the death of his son-in-law, the elder Aaron Burr. He had scarcely entered on the duties of this office when he fell a victim of inoculation for smallpox, 22 March 1758.

The least episodical of thinkers, Edwards wrote no system of philosophy or body of divinity. The connected scheme of his ideas has to be gathered from the large proportions of his various writings on special topics, mainly controversial. The professed aim of the major part of these writings is to defend the distinctive doctrines of Calvinism against the rising tide of Arminianism in the churches inheriting the Calvinistic tradition. He brought to this task a power of keen and relentless dialectic that left no loophole of escape to one who accepted his premises and that fairly wearied and overwhelmed the opponent with the multitudinous array of the argument. He brought also, what more contributed to the originality of his thought, the spirit and profound insights of the speculative philosopher, seeking to ground his theology in metaphysics. Finally, he brought the solid character and the rich religious experience which gave the system for him perpetual practical verification and which certainly, with his moral enthusiasm and vivid imagination, gave it, in his hands, much of its vitality. The central conception about which all his thinking moves is the conception of the absolute sovereignty of God. Metaphysically, God is the sole Reality. Neither Parmenides in ancient, nor Spinoza in modern, philosophy, is more emphatic in the assertion of the One Absolute Reality than Edwards. He, however, does not stop here. God, the Absolute Reality, is with him — it is easy to see that the tradition here blends with his metaphysics — spiritual, personal — tripersonal — and supremely excellent. In his 'Essay on the Trinity' (1903) he develops the doctrine that the Father is the Deity in prime subsistence, the Son the Deity subsisting in the act of God's Knowledge of himself and the Holy Ghost the Deity subsisting in the act of God's infinite Love and delight in himself. This Love of God, which is thus his consummating, essential Excellency, is primarily the love of complacency in the perfection of his Being; but it may be viewed also as benevolent, so far, namely, as it embraces the complete content of the divine Idea in God's Knowledge of himself, and so far as that Idea includes within itself the creative plan of the world and the evolution of its history. Now it is the profound thought of Edwards' dissertation on the 'End for Which God Created the World' (written 1755), the most speculatively philosophical treatise of the 18th century, that such is, in truth, the fact. God finds in himself a *disposition* to produce an emanation from himself in which to reflect his glory and express outwardly his delight in his own excellency. The final end of creation is, therefore, the manifestation of the divine glory in a perfect spiritual society. In his 'History of Redemption,' Edwards endeavors with, to be sure, very inadequate knowledge and, for us, impossible dogmatic assumptions, but with a genuine philosophical purpose, to trace the process through which this end is realized in time. The "emanation," or passage into time, of the eternal world-plan, he represents, in his essay on 'Decrees and Election,' as an act of divine Will, the preservation of the world being a perpetual and continued creation. Beyond this indication of a nexus in the divine Will between the world-plan in idea and in process of realization, Edwards does not go; he develops no theory of the metaphysical relation of the temporal and eternal. He is very clear, however, in teaching that the divine Decree conforms to, indeed is determined by, the divine Wisdom — what must evidently be taken into account in interpreting the many passages in his writings in which he speaks of God's "arbitrary" Will and of his "mere good pleasure." Edwards' early idealism with respect to matter is in thorough agreement with this doctrine of creation, but is not now in question. His whole concern now is with the divine plan relative to man. The problem of supreme interest here, of course, is the problem of moral evil. No one has depicted the nature, extent and consequences of sin in stronger language than Edwards. Sin is with him literally a guilty disposition inherent since the Fall in man's very constitution, as that even infants, that seem innocent to us, "are in God's sight young vipers," so that the whole race merits and, in the absence of "special" grace, which is bestowed only on the definite number of the elect, inevitably tends to horrible and everlasting destruction. Notwithstanding that all this is held to be included in the creative plan, Ed-

wards nevertheless strongly insists on the sinner's responsibility. In his treatise on 'Original Sin' (1758), he brushes aside the legal fictions with which that doctrine was commonly invested, and boldly advances to the Augustinian position that the whole race was really present and really participated in Adam's transgression — a notion which involves him in curious and intricate speculations concerning personal identity. The most celebrated of his writings, the treatise on 'Freedom of the Will' (1754), discusses from other points of view the same general problem of the relation of the creative Decree to the moral life of man. His object in this work was to refute the notion that the will in choosing is so undetermined with respect to its motives as to be able to initiate acts really contingent and, therefore, incapable of being included in God's determinate foreknowledge and decree. He does not deny the fact of choice; "faculty of choice," indeed, is his definition of will. But he contends that this faculty is always determined in its preferences by the strongest motive, "is always as the greatest good is." The connection of such motive and choice is necessary. But the necessity of this connection is quite consistent, in his view, with the liberty to do as one pleases, without hindrance or impediment. He modifies, indeed, the usual Calvinistic doctrine, declaring in one of his letters that man now, even after the Fall, has all the liberty that he ever had. His chief attack is against the notion that will is self-determined, that is, that it determines itself to will, a notion which, thus stated, leads, as he shows, to the infinite regress. But there is nothing in his contention to preclude the idea that it is the whole concrete nature of a self which determines the act of choice. His whole argument, in fact, is based on the thorough-going application of the law of sufficient reason. Each act of will has its reason, or, as Edwards, suggesting a naturalistic interpretation not intended, says, its "cause," from which it follows with "logical" or "moral" necessity. God's Will even is no exception. Human responsibility for sin is not dependent on the way the volition is motived, but on the evil nature of the disposition. The *ultimate* ground or reason of all volition is the divine Idea, comprehending the world-plan, within which every finite being has his place and the realization of which is the effect of the divine decree. God is thus, in a sense, the author of sin, yet not so, as in the case of the human will, that his Will is evil, but so that He, being sovereignly good and perfect and creating the world for a supremely good end, permissively decreed the evil foreseen as comprehended in this purpose.

Thus Edwards, absolutist in metaphysics, ever comes back in his theology to the conception of God as sovereign Power, Wisdom and Love, whose "decrees," determining that the world-plan shall be realized, are the foundation of an all-inclusive optimism. Had he developed his thought as a pure philosopher, his system would doubtless have assumed a very different character in details and in some of its main conclusions. As it was, he blended his philosophy with his theology and his theology with his philosophy and both with a conception and interpretation of Scripture that modern criticism regards as untenable. And although the sharp antitheses in which his system abounds are all reconciled in his thought of God's goodness and eternal decrees, as he lacked the mediating conceptions with which some more modern doctrines have made us familiar, this reconciliation is apt to appear to us as one of faith rather than of reason. These defects, however, will not blind the sympathetic student of opinion to the essential strength and largeness of his general scheme of thought. His historical influence extended mainly in two directions. On the one hand, the speculative and logical power with which he worked out his fundamental conception made him the chief of a school of theologians in New England — Hopkins, Emmons, the younger Edwards, Dwight, etc.— who, with less logical acumen and less speculative ability, sought to carry out his principles and particularly so to formulate the Calvinistic system as to make it appear better accordant with popular notions of the goodness of God and human responsibility. On the other hand, by his doctrine of "spiritual light" and by the emphasis he put on conversion and the religious affections, he powerfully furthered the movement which, laying special stress on religious experience, tends to discard dogmatic assumptions altogether and to seek the solution of the religious problem in the consciousness of this experience itself. See FREEDOM OF THE WILL.

Bibliography.— The best editions of Edwards are the Worcester (8 vols. 1809, reprinted with additions, 4 vols., New York 1858); Dwight, with a memoir (10 vols., 1829–30). Consult also Gardiner, H. N., 'Selected Sermons of Jonathan Edwards' (New York 1904). E. C. Smyth has edited fragments from Edwards from the manuscripts. The best biographies are contained in Dwight's 'Memoir' and in A. V. G. Allen's 'Jonathan Edwards' (Boston 1889).

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EDWARDS, Jonathan (the younger), American theologian: b. Northampton, Mass., 26 May 1745; d. Schenectady, N. Y., 1 Aug. 1801. At the age of six years he went with the family of his parents to Stockbridge, where there was but one school, and that common to the children of both the Indians and white inhabitants, of the latter of whom there were so few that he was in danger of forgetting the English tongue. He so thoroughly learned the language of the Stockbridge Indians, that, as he tells us, all his thoughts ran in their dialect. This knowledge of their language he retained through life. In 1761 he entered the college at Princeton, N. J., at which he was graduated in 1765. After leaving college he studied divinity, and in 1776 was licensed as a preacher of the gospel. In 1769 he was ordained as pastor of the church in White Haven, in the town of New Haven, Conn., where he continued till May 1795. Resigning this charge, mainly on account of difference in doctrinal views between himself and some of his people, he was settled in 1796 as pastor of the church in Colebrook 1796–99, where, in addition to professional duties, his time was devoted to his favorite studies, and to an extensive correspondence which he had long carried on with learned men both in this country and in Europe. In May 1799 he became president of Union College, Schenectady, which office he

filled at the time of his death. He was the author of a treatise on 'Liberty and Necessity' (1797); and 'Discourses on the Atonement' (1785), which were published with a memoir by Tryon Edwards (2 vols., Andover 1842).

EDWARDS, Matilda Barbara Betham-. See BETHAM-EDWARDS, MATILDA.

EDWARDS, Ninian, American political leader: b. Montgomery County, Md., March 1775; d. Belleville, Ill., 20 July 1833. He was graduated at Dickinson College, moved to the Green River district, Ky., studied law and was admitted to the bar in Kentucky and in Tennessee. He rose rapidly in his profession, was judge of the General Court of Kentucky, of the Circuit Court and of the Court of Appeals, and chief justice of the State Supreme Court. In 1809 he was appointed governor of the newly organized territory of Illinois, and held that office till Illinois was admitted as a State. During his administration he organized companies of volunteer rangers and built a line of stockade forts which were of special value in the border wars with the Indians and in the War of 1812. In 1816 he was one of three commissioners appointed to treat with the Indian tribes. In 1818 he was elected to the United States Senate from Illinois and served six years; and in 1826 he was elected governor of the State, holding that office till 1830. Consult Edwards, 'History of Illinois and Life of Ninian Edwards' (1870).

EDWARDS, William, American inventor: b. Elizabeth, N. J., 11 Nov. 1770; d. Brooklyn, N. Y., 1 Dec. 1851. After receiving a common school education he learned the tanning trade and built his own tannery at Northampton, Mass., but eventually settled in Hunter, Greene County, N. Y. Here he opened a model tannery, with improvements in manufacturing appliances originated by himself. His principal invention was a leather-rolling machine which saved the labor of hammering. H. invented other machines and utilized water power to such an extent as practically to revolutionize the tanning business in the United States, improve the quality of shoe leather and cheapen its cost. His 'Memoirs' were published in Washington (1897).

EDWARDSVILLE, Ill., city, county-seat of Madison County, on the Illinois Terminal, the T., St. L. and K. C. and the Wabash railroads, about 70 miles southwest of Springfield and 20 miles northeast of Saint Louis, Mo. It is the centre of a coal mining and agricultural region. The chief industries are the manufacture of tools and hardware. Edwardsville was the former location of the Kickapoo Agency, which was the instrument in accomplishing the transfer of a large part of the present central United States from the Indians. Pop. 5,014.

EDWIN, king of Northumbria: b. about 585; d. 633. He was the son of Ella, who seems to have ruled that kingdom from 559 to 589. Being an infant at his father's death the crown was seized by Ethelfrith of Bernicia. The young prince was sent for protection to the court of Redwald, king of East Anglia, by whose aid he was eventually put upon the throne (617). He organized the kingdom of Northumbria and greatly extended his dominions, until they reached Edinburgh on the north. He married Ethelburga, daughter of Ethelbert of Kent, and by her influence and that of Paulinus, a Roman missionary whom she had brought from her father's court, was led to embrace Christianity and make it the religion of his people. He was baptized in 627 at York, where he built the first church of wood. The Mercians, under Penda, revolted against the supremacy claimed by the Northumbrians, and the war which ensued was closed by a battle at Heathfield or Hatfield in Yorkshire, in which Edwin was defeated and slain. Consult Green, 'The Making of England' (London and New York 1881).

EDWIN DROOD. See MYSTERY OF EDWIN DROOD.

EDWY, or **EADWIG,** king of England: b. about 938; d. 958. He was the son of Edmund I and succeeded his uncle Edred in 955. Taking part with the secular clergy against the monks he incurred the confirmed enmity of the latter. Having called Dunstan to account for his share in the administration in the preceding reign the latter refused to attend the summons and was, in consequence, banished. His party was, however, so strong that a rebellion was excited and Edwy driven from the throne to make way for his brother Edgar. Consult Oman, 'England Before the Norman Conquest' (London 1910).

EECKHOUT, ĕk'howt, or **ECKHOUT, Gerbrand van den,** Dutch painter: b. Amsterdam, 19 Aug. 1621; d. there, 22 July 1674. He was one of the pupils of Rembrandt and in some measure successful in imitating his manner, especially in the early part of his life. He excelled chiefly in painting portraits and these as well as his historical pictures abound in the best collections of Holland, while several of them are to be found in Germany. Among his most representative portraits are 'A Man and a Woman in Black' (Darmstadt Gallery); and the portraits of Dapper, the historian (Frankfort), and Jan de Witt (Grenoble Museum). Of his religious subjects may be mentioned 'The Presentation in the Temple' (Dresden Gallery); 'Jacob's Dream' (ib.); and 'The Raising of Jairus' Daughter' (Berlin Museum).

EECLOO, ā-klō', Belgium, town in province of East Flanders, 11 miles northwest from Ghent, near the Lièvе. The manufactures are chiefly woolens, cottons, lace, hats, tobacco, chocolate, soap and starch; and it has breweries, distilleries, salt-refineries, dye-works and oil-mills, and an active trade in grain, linen, cattle and timber. Pop. 13,536.

EEDEN, ā'den, **Frederik van,** Dutch author: b. Haarlem, 1860. He was educated at the University of Amsterdam and settled as a practising physician at Büsum. His first work, 'De kleine Johannes' (1887; 6th ed., 1900), was a very popular story of animal life. Other important works from his pen are the poems 'Johannes Viator' (1892); 'Ellen' (1891); 'De passieloose Lelie' (1901); 'Enkele Verzen' (1898); 'Van de Koele meren des doods' a novel (1900); and the dramas 'Ysbrand' (1910) and 'Lioba' (1912).

EEKHOUD, ĕk'howt, **Georges,** Belgian novelist and poet: b. Antwerp, 27 May 1854. He

first published two volumes of poetry, 'Myrtes et cyprès' (1876) and 'Les pittoresques' (1877); then became a newspaper literary critic in Brussels and wrote several short stories. His first noteworthy novel, 'Les milices de Saint-François' (1886), is a masterly portrayal of Flemish peasant life, especially its naïve mystic religiousness. His masterpiece, 'La nouvelle Carthage' (1888), paints Antwerp life in its naked actuality. Still other works of his are 'Les fusillés de Malines' (1890), a story of the peasants' uprising against the French in 1798, and 'La faneuse d'amour' (1900), and 'L'Autre vue' (1905). In poetry he has developed from romanticism to pronounced realism.

EEL, the general name given to a variety of teleostomous fishes of diverse structure and resembling one another chiefly in their elongated form, soft rayed fins and the tendency for the paired fins to become reduced in size. Although their seclusive habits render the eel-like fishes liable to be overlooked, and it is evident that many remain undiscovered, the number and diversity of those already known are very considerable. Ichthyologists have arranged them in numerous families and several orders, which Prof. E. D. Cope regarded as forming a series degenerate in respect to the gradual loss of the paired fins and certain ossifications of the skull, and in the simplification of the gill arches. According to the classification of Jordan and Evermann, most of the eels fall within the order Apodes, the others chiefly within the *Plectospondyli Symbranchia* and *Carenchelyi*. The common eel or fresh-water eel (*Anguilla chryspa*) belongs to the first order and the family Anguillidæ. It is doubtfully distinct from the European fresh-water eel (*Anguilla anguilla*). Both species are characterized — in addition to the serpent-like elongated body, the absence of ventral fins and the continuity of the dorsal and anal fins round the extremity of the tail — by the wide interval between the dorsal fin and the head, the projecting lower jaw, well-developed pectoral fins, well-ossified jaws and gill covers and nearly perfect gill arches. Contrary to the common belief, eels are not scaleless but numerous small scales are embedded in the skin. The life history of the eel is very remarkable and in some respects unique. During the spring and early summer multitudes of young eels several inches long migrate up the rivers from the sea and distribute themselves throughout every accessible body of water, whatever its size or character, frequently traveling overland to reach these. Here they remain concealed in the mud or beneath stones and feed on all kinds of animal matter, living and dead, in the pursuit of which they are relentless. Many eels appear never to leave the fresh waters in which they have developed, but most of them after several years return to the sea and enter comparatively deep waters, where sexual maturity and spawning takes place. From the egg a peculiar, compressed, transparent, pelagic larva (*Leptocephalus brevirostris*) is produced, which in due time generally metamorphoses into the young eel which in turn leaves the sea. Some individuals, however, appear to remain permanently in salt as others do in fresh water.

Both in America and in Europe eels are an important and very excellent food fish, and great quantities are caught in a variety of ways. In the United States use is made of hand and set lines, eel-spears, eel-pots and weirs. The last is the most efficacious method, but owing to its serious destructiveness of shad and other fishes its use is frequently prohibited by law. A V-shaped fence or net is arranged across the stream with a basket placed in a small opening at the apex, into which the eels are guided by the leads and from which they are unable to extricate themselves. In England river eels are caught in great numbers by means of eelbucks, or eel-pots, traps consisting of a kind of basket with a funnel-shaped entrance composed of willow rods converging toward a point, so that the eels can easily force their way in but cannot return. A stocking or tube of coarse cloth hanging from an aperture of a box down into the interior is also used. A kind of trident, called an eel-spear, is used also for taking them. A fisherman wades to the shallows, and, striking his spear in the mud in every direction around him, the eels reposing on the bottom are caught behind the prongs. Except a few other species of the same genus as the common eel, all eels are strictly marine and are especially numerous in tropical seas where, in the interstices of coral reefs, as also in the deep sea, some very remarkable kinds occur. For an account of the species consult Jordan and Davis, 'Report United States Fish Commission for 1888'; Jordan and Evermann, 'Bulletin United States National Museum, No. 47, Part I,' and Goode and Bean, 'Oceanic Icthyology.' See also articles CONGER EEL; ELECTRIC EEL; SNIPE EEL; MORAYS; PELICAN FISH; SNAKE EEL, etc.

EEL-GRASS, or **GRASS-WRACK**, a common name for a marine plant, *Zostera marina*, of the pondweed family (*Naiadaceæ*). The leaves are narrow and ribbon-like, blunt at the end, sometimes six feet in length. The flowers are crowded in a spadix. It is found in bays or streams along the Atlantic coast from Greenland to Florida, and on the Pacific from Alaska to California, also on the shores of Europe and Asia. The genus *Zostera* (from the Greek, referring to the ribbon-like leaves), comprises six species, of which two besides the eel-grass are found in America. They are all marine plants, and are found on the coasts in the north temperate zone.

EEL-POUT, the name of various fishes. It is applied in the United States to the burbot or ling of the Great Lakes and to the mutton-fish; in Great Britain to the burbot and in northern Africa to the electric catfish (*Malapterurus*).

EELWORM, or **VINEGAR EEL** (*Anguillula aceti*), a small *Nematoda* worm of the family *Anguillulidæ*, often found in immense numbers in good cider vinegar or in sour paste, where it feeds on the mucilage and organic fluids. It is just visible to the naked eye and wriggles very actively. Like many related species it is very resistant to dessication and other influences ordinarily destructive to animal life. A vast number of similar species live in the earth and feed on decaying organic matter, others are parasitic on plants, in which they are at least the partial causes of certain very serious diseases; thus *Tylenchus devastatrix* causes the "clover disease" and *Heterodera schachtii* the still more destructive "beet sickness," which

sometimes devastates the sugar beet crop of Germany. Consult Neal, 'United States Department of Agriculture, Bulletin 20' (Washington 1889).

EFFENDI, a title of respect among the Turks, bestowed on civil officials and on educated persons generally, in contradistinction to the military title of *aga*. It is nearly equivalent to Mr., Sir, or the French *Monsieur*, but is suffixed to the personal name. It is often attached to official titles.

EFFICIENCY. See INTERNAL COMBUSTION ENGINE.

EFFICIENCY, Mechanical. See LOCOMOTIVE.

EFFICIENCY ENGINEERING. Efficiency, a word comparatively modern in use, for which there is no equivalent word in French, Italian, Russian, Swedish, German, can be defined as the industrial relation between what is and what ought to be, between the actual and the standard. To find time efficiency divide the standard time by the actual time. The standard time for a trotting record is 2 minutes. If the actual time is 2 minutes 30 seconds, the efficiency is 80 per cent. To find output efficiency, divide the actual by the standard. If for an hour the walking standard for a man is four miles and the actual performance is five miles, the man's walking efficiency is 125 per cent. Another definition of efficiency is to do the standard performance in the standard time, at the standard place, for the standard cost.

To an almost incredible degree railroads operate to efficiency standards. The time table sets up thousands of time standards for standard performances at standard costs, reaching particular places with standard equipment. Efficiency standards can be applied to all the seven great divisions of human activity, which are: Production commanding a price; manufacture taking a profit; transportation exacting a toll, rate or tariff; storage, for which rent is charged; exchange, earning a commission; personal service, exacting a fee; parasitism, which steals or robs.

Efficiency engineering belongs in the personal service group. There is a subclass in this group, the ethical class, whose service consists in lessening the wastes in the use of the already appropriated resources of the universe, in order that humanity may be better. The prophets and priests, by inculcating morality, have tried to lessen the wastes due to wickedness and sin. The physicians and surgeons have tried to lessen the wastes due to sickness, disease, early decay and death, bodily defects. The scholars, students, teachers have tried to lessen the wastes due to ignorance. The efficiency engineers have tried to lessen the wastes due to unscientific control and direction of the great divisions of activity in their three elements of materials, personnel and equipment. Everybody realizes the immense wastes due to wickedness. They are exemplified in the great war brought about by recent diplomacy, by violations of treaties, by ambitious and unscrupulous men, by disregard of what we had come to believe were accepted principles of humanity, of religion, of civilization. Everybody realizes the immense wastes due to disease which again and again has almost depopulated the world, which to-day makes infant mortality a greater drain on human life than the casualties of the batterfields and of the seas. Everybody realizes that an illiterate and unschooled population produces little wealth. Before the World War, the daily preventable losses in the United States, due to industrial inefficiency, amounted to not less than $40,000,000. In a manufacturing plant the difference in productive value between two men, one of 50 per cent efficiency and the other of 120 per cent efficiency, quite usual variations, may amount to $4,000 a year, even if each is using similar equipment.

Modern efficiency is much lower than that of former ages. By this is meant that although modern man has much more at his disposal than his ancestors, he nevertheless uses his greater resources far more wastefully. The Chinese coolie delivers a maximum all the time. The cause of modern inefficiency is the operation of the law of dependent sequences. Many modern operations are in dependent sequence. In printing with one color 10 per cent of the sheets may be spoiled. Add another color and in the second run we have another loss of 10 per cent. If there are four printings the efficiency falls to 90 x 90 x 90 x 90 equals 65.61 per cent. If there were eight colors the end result would be only 40 sheets. Ninety per cent is a very high efficiency yet in repetition it sinks. The remedy is possible also through dependent sequence. Improve each step 5 per cent and for four operations of 95 per cent in sequence we have the end result of 81.45 instead of 65.61. Increase the sequences to eight of 95 per cent and the end result is 66.34 instead of 43. A gain in efficiency of 5 per cent gives an end gain of more than 50 per cent.

It is the function of efficiency engineering to eliminate or at least lessen industrial losses, especially those due to dependent sequence. Efficiency engineering, the accomplishing of results with less materials, less human effort, less equipment, is very old. Jethro, a rank outsider, gave Moses excellent efficiency counsel: «Thou shalt teach them ordinances and laws, and shalt show them the way wherein they must walk and the work they must do. So Moses harkened to the voice of his father-in-law and did all that he had said.» Christ constantly both by precept and example showed how to accomplish much with a minimum of effort. Hideyoshi, the great Japanese reformer of the 16th century, originated and put into practice many efficiency engineering methods, reducing the castle fuel cost to one-third; building a wall in three days instead of three weeks, although he abolished overtime and paid a bonus; conquering a strong castle single-handed, although his lord had lost 5,000 men in a previous futile attempt.

Efficiency engineering began to emerge as a distinct branch of science when the doctrines of the correlation of forces and conservation of energy were accepted. It acquired solid footing when Joules experimentally and Meyer deductively established that 774 foot pounds could be converted into a rise of temperature of one degree Fahrenheit in a pound of water, or, vice-versa, that this amount of heat would raise 774 pounds one foot. Yet when either of these feats was attempted experimentally, there was great loss. It became the duty of

the efficiency engineer to discover the losses, then to minimize them. The standard had been established, accepted. This was the aim or ideal. The next step was to examine and set forth the actual conditions, so different from the standard. The next step, the peculiar function of efficiency engineering, was so to better actuality, so continuously and intelligently to remove the friction and other losses, as to force the actual gradually to approximate the ideal. The standard was there. It could be realized to the extent of 30 per cent, 60 per cent, perhaps 99 per cent, an efficiency of 30, of 60, of 99 per cent could be attained.

There are a definite number of heat units in a pound of coal, but how much energy is there in a man? A horse power is conventionally stated as 33,000 foot pounds a minute. The weight of the horse, an all-important item, is not given. Let us assume it as 1,200 pounds. The potential energy of all animals is in proportion to the daily calories eaten and this again is often proportional to the weight. A man weighing 120 pounds is capable of delivering 3,300 foot pounds a minute or one-tenth of a horse power. Can a man climb a mountain 5,000 feet high in three hours? He can. Could he do more? By studying heart beats, respiration, muscle fatigue, it was ascertained that without undue strain a man could for any period up to 12 hours do about one-half of the maximum attained for the same period. The reasons for short hours are not that the man will wear out from overstrain or fatigue, but to give him time for other than working interests. There are outputs of energy so severe that they can be endured but a few seconds a day, as running 100 yards in 10 seconds. There are other occupations so quiescent, as that of a watchman at a gate, that even 16 hours a day would not exhaust nor brutalize. It is one of the chief functions of the efficiency engineer to set physiological and physical standards, also with due consideration of the psychological. A man can do more when he is interested, when he is stimulated, when he is well, when he is skilled, when he works in form.

The efficiency engineer is the opposite of the accountant. The accountant is concerned with authority, with allotment of charges and credits and with accuracy. No one can open an account in a bank until authority has been granted. The deposits must be most carefully credited to the right account and similarly all checks must be charged to the right account. Finally by long tradition and correct practice both deposits and withdrawals must be most accurately summed up. The accountant is much concerned when the two sides of his statement do not balance to a cent. The efficiency engineer is very little concerned with either authority, allotment or accuracy. He wants to know the aim. It may be to obtain a horse power from one pound of coal, an aim much below what is theoretically possible. In establishing this aim he uses not theory but common sense. The aim may have been already attained, sometime, somewhere. It may almost have been attained under conditions that could be bettered. He next wants to know the actual state of the art which may be using five pounds of coal. The actuality is subjected in its every step to close and intelligent investigation. All along the line from coal in mine to ash pile and escaping smoke, through all the dependent sequences of faulty equipment, transportation, furnace, boilers, piping, engine, transmission members, there are a series of little wastes. By patient elimination or at least improvement of the successive steps wastes are cut down to such an extent that the aim is realized. The first question should, however, always be — Is the aim worth while? Should power be produced? The Eskimo who floated up the estuary on the incoming tide, who crossed by means of a sail and who came down on the ebb utilized in succession moon, sun and earth as his motive powers and neither of his prime movers could be improved in efficiency. The white man, too impatient to wait for tide and wind, uses coal, utilizes at best only one-fifth of its power.

The efficiency engineer regards all results as made up of material contributions, personal contributions and equipment contributions. These three different elements are subject to very different laws and cannot be treated in the same manner. Materials require storage and careful use. Equipment requires storage, careful use, and in addition continuous, high-grade maintenance. Personnel requires housing, direction, high-grade maintenance, but in addition a far-reaching psychological control. Everyone owning a motor car knows that the fuel, the car and the chauffeur are different problems.

In the subclass United States railroads of the larger division of transportation, the relation of materials, personnel and equipment charges are 3:5:7. In the packing industry materials (cattle, hogs) are overwhelmingly important, personnel comes next and equipment last. Because of these differences railroads turn over their capital once in five years, have to operate at low ratio, 60 per cent to 75 per cent, and are lucky to pay 5 per cent or 6 per cent dividends, while the big packing industry turns over its capital five to six times a year, operates on a margin between cost and sales of 2 per cent or 3 per cent and can pay 20 per cent dividends. In these combinations of material, personnel, equipment, any one or more may be high in efficiency, any one or more may be low. A first class man may be running a very poor machine or vice-versa. To a good furnace poor coal may be fed or good coal may be fed under a poor boiler. But the combination to be controlled and regulated is not only of materials, personnel and equipment, it is as to each a further combination of quantity and quality, each with its own efficiencies. This leads to the universal formula for production, a formula that equally applies to all the battling hosts of Europe, or to the operations of all the railroads or to the making of a pin.

UNIVERSAL FORMULA

Costs = Materials + Man Costs + Equipment Charges

Costs = $QP + TW + tR$

Materials = QP in which Q is quantity of units and P is price per unit.

Personnel = TW in which T is total hours of work of all men for the period and W is average rate of wages per hour.

Equipment = tR in which t is hours each day and R is rate per hour for all equipment for the period.

When the efficiency engineer has thus stated

his problem he attempts to bring about that combination of Q and P, of T and W, of t and R which will make the cost of each group a minimum. What combination of materials, of personnel, of equipment is under the circumstances most rational? Shall it be little equipment and many men or shall it be much equipment and few men? The sand along the Suez Canal was removed in part by young women, digging with their bare hands, carrying the load in baskets on their heads and dumping it on the bank. At Panama immense steam dredges were used, scraping 10-ton loads at a stroke, yet the cubic yard of excavation may have cost more at Panama than at Suez. Which was the better method? The cheapest transportation the world has perhaps ever known was of ivory, hides, etc., from the interior of Africa to the sea coast. But it was one-way traffic. The means of transport, slaves, bought for a few dollars in the interior, were worth hundreds of dollars each at the coast. In this case in the universal equation PQ, materials is very small, tR, equipment, is less, TW, wages is negative, since the sale of the slave brought a revenue. But after the questions of relative proportion of materials, of personnel and of equipment have been settled the next problem is to determine whether large quantity and low quality is better than small quantity and high quality. Is it cheaper to build a bridge out of cast iron blocks at $20 a ton or out of piano wire at $200 a ton? Efficiency engineering is immediately concerned with industrial wastes not with moral wastes. It may be a great moral shortcoming to use up frivolously the coal, the natural gas and the crude oil of the world but from the point of view of the efficiency engineer the Diesel engine in a submarine may be efficient and a burden bearing Bhudda be inefficient. Is it cheaper to walk 500 miles barefoot in 25 days or to go through in a night on a fast train? If wages are $0.10 a day and meals cost nothing it would be cheaper for some men to walk, as the tramps do. With board and lodging at $0.25 a day and wages at 0.40 a day it is cheaper to ride.

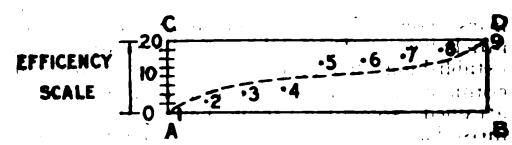
Usually economy is secured by increasing the quality items, price, wage rate, equipment rate, thus reducing the quantity items of weight and of time. The best result is when the value produced is a maximum with QP, T, and tR very small, but W very large. An infinitely bad result is when QP, TW and tR are a maximum, millions of costly shells, millions of hours of time daily with low wages, 24 hours a day of almost infinitely costly equipment, all to produce unmeasured and unmeasurable destruction. There are different summarized efficiencies for each of the six factors Q, P, T, W, t, R. There are different efficiencies for each separate part of each. Each of a thousand men in a plant will have a different average efficiency and each man will have a different efficiency for each different item of work. To check all these million possibilities of wastes and leaks becomes as necessary as to have every joint tight in a 100-mile pipe line, to have every rail in a 1,000-mile road, sound and in line, or to have every item right in the deposits and withdrawals from a bank, or to have every word, every letter, in a book proofread.

Nevertheless it has been found efficient to attack inefficiencies under group headings rather than individually on the same principle that it is better to prevent any yellow fever mosquitoes rather than to kill those that fly around. The systematic application of a few principles, some ethical, some practical, brings about general improvement: (1) What is the main ideal? Stick closely to it. Eliminate clashes and interferences. Fast trains are run on the principle of the free and unobstructed track. (2) Is common sense being used? Mostly it is absent, as in the adoption of a cost plus profit plan by the United States government, for its war orders. (3) Has the best advice been sought, been considered and been followed? (4) Is there the strict discipline, the spirit, that makes the difference between army and mob? (5) Is the fair deal practised toward all? (6) Is there a direct and tangible connection between individual excellence of performance and individual pay? (7) Are all operations minutely planned in advance? (8) Are they carefully and scientifically scheduled as to time and cost? (9) Are all operations dispatched, i.e., put through in accordance with plan and schedule? (10) Are all conditions standarized? (11) Are all operations standardized? (12) Are there permanent written standard practice instructions? (13) Are there records, necessary, reliable, immediate, adequate, convenient? It is the method of group attack that has proved important rather than the particular principles for which others might be substituted.

An able teacher has enunciated the three principles of picking the right man, giving him power, letting him alone. This is excellent but it leaves us without means of analyzing results. Not so many years ago, some blacksmiths pretended to be able to smell the quality of iron and to judge of the heat by the color. To-day steel quality depends on alloy and heat treatment. We still depend on the good man but we check him and perpetuate his excellence by analysis and pyrometers, and for efficiency work a few principles are very useful. In considering the human element in production it is important to encourage every man to make the most of himself, whatever the conditions. There are noble chiefs in Indian villages. It is not less important to so establish conditions that each man whether inferior, average or superior can accomplish most. The wise Indian chief had he been in different surroundings might have been a Lincoln, a Lloyd-George.

A diagram often used by teachers of efficiency consists of a series of rectangles illustrating by their height the excellence of conditions and by dots above the base the achievement of the individual.

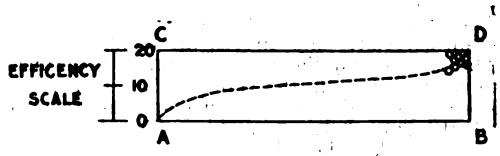
VERY BAD CONDITIONS AND AN AVERAGED GROUP OF MEN. AVERAGE ATTAINMENT 10 PER CENT.



Each individual starts along the life line AD at A. Some get no farther than 1, others

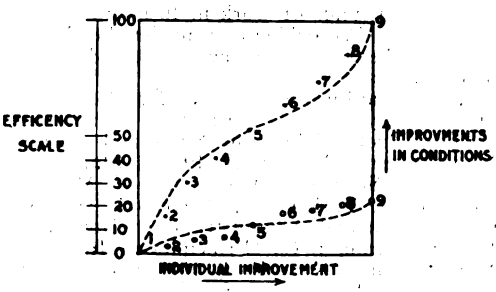
progress as far as 2, still others press on to higher positions until the best man of all, a superman (9) makes D. The position on the line AD is determined by the characteristics of the individual, by heredity, is the same kind of difference as exists between the eagle and the rooster, in the egg scarcely distinguishable. If all the 9 men that entered at A were of the quality of number 9, they would all ultimately bunch about D.

VERY BAD CONDITIONS AND A GROUP OF SUPERMEN. AVERAGE ATTAINMENT, 20 PER CENT.



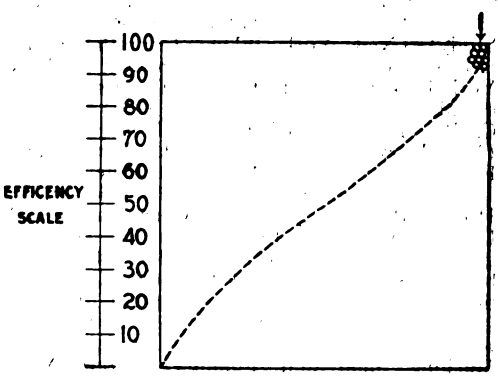
Under the same conditions the superior group of very unusual men will average twice as well as an average group of unselected men.

BEST POSSIBLE CONDITIONS AND THE EFFECT ON AN AVERAGED GROUP OF MEN.



This diagram illustrates that owing to improved conditions each man will have risen perpendicularly so that the average efficiency

BEST CONDITIONS AND A GROUP OF SUPERMEN. SUPERMEN UNDER BEST CONDITIONS.



is now 50 per cent instead of 10 per cent. Under these bettered conditions it is no harder for man 9 to reach 100 per cent absolute than it was under bad conditions to reach 20 per cent absolute. Under both conditions this man is doing twice as much as a normal standard (half of the best record) and any unusual performance is not a matter for expectation or of requirement but of free will. Men ought not to be permitted to be slackers and we can consider all workers below the average of their class and group as slackers and near-slackers. Neither has the community any right to demand a performance above the average. In war when extra-hazardous work impends volunteers are called for. Similarly in industrial life, it is a matter for the individual to decide whether he will be 20, 50, 100 per cent better than the average. The obligation of the community not to discourage, hinder and prevent super performance is even greater than to prevent slacking. The world owes its advances and the progress of civilization to the superman, to the Columbus, the Newton.

It is of course possible to collect a group built of superworkers, as in a league base ball team, or in the best college foot ball teams, or in an orchestra, or in a circus, where every living performer is a star. Such groups will always be abnormal, but the superman of one age may be the average man of a better age. The performance of supermen under best conditions is about 10 times as productive as that of the average man under bad conditions.

It is as distinctly the province of efficiency to discover and state best industrial methods as is it the province of moralists to discover and attain universally highest morality, the province of educators to outline and attain universally highest knowledge, the province of health specialists to outline and attain for us all highest physical soundness. Efficiency is not a new phenomena, it has, however, only recently been clearly recognized and studied. Some of the best examples of efficiency practice have been outside of industrial lines. An orchestra is one of the best instances of efficiency organization and efficiency attainment. The leader is a trained and experienced specialist of great and unusual aptitude. Every worker is a superman, of special aptitude, training and experience. He is equipped with marvelously perfect tools or instruments. The work is also planned in advance, with written standard practice instructions, scheduling it most minutely not only as to time but as to quality. The work is dispatched and executed to the fraction of a second. No man plays independently but all are exactly adjusted to each other, yet the players like it and thrive under it and the best are abundantly rewarded. But orchestras are very old.

A more modern example is that of the trotting horse. The trotting horse men, who may not know what the word efficiency means, have nevertheless elaborated the very best plans for attaining it: (1) They began with heredity, counting more on blood and descent as a foundation than on anything else; (2) the dam of the colt and the colt itself are given the best of environment; (3) the training begins early and is continuons; (4) actual experience and tests follow; (5) there is the most skilled leadership.

So much for the physiological and psychological problems. Lastly, conditions are standardized to the utmost. Harness in all its parts, sulky in all its parts, shoes, track (shape, banking and surface). Operations are then standardized. The stop watch was first used on trotting horses. Race horse men were familiar with fifths of seconds and their value long before time studies were thought of in industrial shops. The first photographic motion studies

ever made were by Muybridge of trotting horses. Since the record of 2.40 of Flora Temple about 1840, the improvement has been steady to the present record of 1.58. Probably one-half of this is due to improved heredity, the other half to improved environment, training, education and accessories. As a consequence the performance of the trotter is the performance of the superhorse under best of conditions. The best trotting horse can travel at the rate of a mile in two minutes. Under the usual conditions of trail a horse or mule does well to travel a mile in 20 minutes.

The need of consistent application of modern research methods to the problems of economic production and consistent improvement of basic units whether materials, personnel or equipment, have attained growing importance during the last 50 years.

Mr. Taylor thus outlines Functional Type of Organization. "Throughout the whole field of management the military type of organization should be abandoned and the functional type instituted. Functional Management consists in so dividing the work of management that each man, from the assistant superintendent down, shall have as few functions as possible to perform. The most marked characteristic of functional management lies in the fact that each workman secures his daily orders and help directly from eight different bosses. Four of these are in the planning room. Four others are in the shop. The four shop bosses are gang boss, speed boss, inspector, repair boss. The four planning room bosses are order of work clerk, instruction card man, time and cost clerk, shop disciplinarian."

In machine shop practice F. W. Taylor made epoch-making demonstrations of the gains to be realized from improvements in belting, improvements in the art of cutting metals, which virtually scrapped all the machine shop equipments of the world, and improvements of shop management. Taylor expanded from a shop man into a world teacher. It is not without importance that Taylor had had the benefit of French school training, the passion for the new, the logic and precisive. About the same time, 1900, as Taylor was breaking from the shop into world prominence, other men with the widest of world experiences were descending into the shop, carrying into it world ideals of principles, of organization, of administration, of selection. Taylor rejected the old military line that had existed in shops, president, manager, superintendent, foreman, gang boss and substituted what he called functional management. He points out that whereas it would be very difficult and expensive to secure any single man with all the nine qualities required in a foreman, it is easier and cheaper to find a few men, each with some of the qualities, so that four men may cover and to spare the nine functions which in his work on shop management Taylor defines. The Emerson school developed the practical application, to modern industry, of natural organization as it occurs in the animal and plant life. Natural animal organization falls into four parts: (1) The fundamental organs of growth and upkeep, working continuously at low intensity and almost automatically; (2) the counsellors, or the sense organs which look ahead and note both the exceptional and the infinitely minute; (3) the central brain, which constantly counsels, correlates and directs; (4) the doers, creators, whose law of action is directed spasmodic intensity. Natural plant organization covers time and relations. A plant rooted to one bleak spot survives 3,000 years with 3,000 generations of leaves. The humble plants render service to insect and animal that in turn greater service may be rendered them. These facts are a source of inspiration and information only beginning to be recognized and utilized. The natural types of organization embody the principles of both functional and staff and line organization. The brain and the hands are in the line. The brain correlates and directs, the hands execute. The senses and the interior organs are functional therefore in the staff. A line man must know how to direct. A staff man must furnish all the knowledge available. The line man usually makes the mistake of thinking that he knows. The staff man makes the mistake of thinking that he can direct. It is no part of the plan or aim of efficiency engineering to overstrain materials, to break down equipment or to overwork men. There is a rational load for either of the three. A man can always do more foot pounds of work in 16 hours than in 12, 10 or 8. We deliberately prefer the shorter intervals because economy is subsidiary to human welfare.

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EFFICIENCY SOCIETY, a nation-wide movement, not for promoting efficiency in the field where engineers have already done so much, but rather for extending the principles of efficient engineering to all other relations of life. The 18th was the theologic century, when man's chief thought was his relations to the Deity. The 19th was the scientific century, when man was much concerned with his relation to nature and its forces. The 20th century will be known as the efficient century, when the world demanded of every man and institution, as it demanded of every approved machine, that its work be done better, quicker or cheaper, under penalty of discard, and this meant raising the ratio of results achieved to efforts expended, which is the engineer's definition of efficiency. From creation whenever any man made a distinct effort to improve his methods or his tools so to get greater results from the time and labor spent, he had in him the elements of the efficiency expert. Steam is as old as the first hot fire under water, and electricity is coeval with the lightning, but the age of steam and electricity is recent. This is the century of efficiency; for in its early years attention was widely drawn to the fact that the progress to which the world aspired was possible only by applying to all of life the lessons learned from machines. Every method, man or institution that maintains its place must prove ability to do something that the busy world wants either better or quicker or cheaper. America leads the world because she studied profoundly her machines. She standardized, and thus both improved output and greatly reduced cost. She cut out every useless part and every needless pound. She added power and speed and eliminated every false motion. As a result she made thousands of useful articles at 50 per cent, 20 per cent, 10 per cent or even 1 per cent of their previous cost in time and labor, i.e., she increased that efficiency 2 to 100 fold. Man with his machines became as a god. Instead of a birch bark canoe he built ships that would carry all the inhabitants of 20 villages of 400 people each and cost as much as all the land and houses of 100 such villages. He sent trains carrying a thousand people through tunnels and solid rock, under cities and rivers, at 10 times the speed of a footman. He sails under the sea or through the air with the speed and accuracy of fish and bird. He talks as if in the same room across a continent or under the Atlantic. He omits the wire and in a few seconds can send his message to every part of the boundless sea. In his phonograph we hear the familiar voices of those long dead, and on the screen their pictures move exactly as they did in life. Man saw these miracles of efficiency on every side and began to question strongly everything in life: "Are we giving this more time, thought, labor or capital than absolutely necessary to produce results fully up to efficiency standard, or what the golfer would call bogey?" Modern life is more or less a race or struggle in which only the fittest can survive the fierce competition between individuals, corporations, communities, states or nations. They keep adding speed and power and looking for any useless pound of weight that can be thrown overboard. In the great contests of life the leaders strip like athletes in the Olympic games. But still in a time of coal famine experts startle us with their claim that we often really use only 5 or 10 per cent of the heat locked up in the coal we burn. Many food supplies yield the farmer who produces perhaps half what he should have, yet the laborer who buys in small quantities pays double what he can afford for that same article. This means low efficiency in the farm-to-family machine. See FARMERS' CO-OPERATIVE MOVEMENT.

College graduates often show unfitness to transact simple business after giving 16 years to training for life, and we cry for more efficient education. We have countless millions in our churches and they have done great good, yet in great crises of war, panic or plague, we deplore that more of the efficiency of the American machine is not found in our churches. We hear of millions dying for lack of food and shelter and learn that with our boasted efficiency in many lines we are the most wasteful nation the world has known. The new idea was that by persistent, systematic study and comparison of experiments and experience we might approximate in the manifold relations of life an increased efficiency comparable to that so obvious in our machines. This great idea appealed to leaders and thinkers in many fields. Over a thousand joined the Efficiency Society organized at a national convention held in the Engineering Building, New York, 18 March 1912. J. G. Cannon, president of the Fourth National Bank, was president, and its officers and committees included many of the best-known men in America. Its constitution says "its object is to promote efficiency or percentage of results obtained relative to effort expended in every activity of man and in everything he employs." On 12 Feb. 1916, the National Institute of Efficiency was incorporated in Washington to supplement the work of the older society by making widely available throughout the country the results of research and experiments as developed and focalized by its committees. On its board of governors were leaders from a dozen different States. The general absorption in the Great War led both Society and Institute to defer much of the work planned, and later they were combined in a single National Efficiency Society incorporated in Washington but with headquarters at 119 West 40th street, New York, where fuller information can be had. It publishes a quarterly and has made *The Independent* its official journal, sent weekly to all members. It also publishes efficiency monographs from time to time and provides free or at reduced cost books and pamphlets of special interest to its members. It plans meetings and provides speakers, and through its officers and committees tries to focalize and disseminate for the public good anything likely to be widely useful to those specially interested in increasing efficiency. It does not assume to go into details of special callings, which are best treated by their own

local and national associations. It is thus a union of those willing to turn over for the common good the results of their own studies, and all such are welcomed to its membership. In friendly co-operation with the leaders of other enlightened nations its ultimate goal can be safely prophesied as "The Federation of the World for Greater Efficiency."

MELVIL DEWEY,
President, National Efficiency Society.

EFFIGY, formerly **EFFIGIE,** (1) a copy or imitation of an object, an image or likeness; in sculpture frequently applied to the figures on sepulchral monuments; (2) to execute or degrade, as the execution or degradation of a condemned criminal, when he cannot be personally apprehended, by subjecting his image to the formalities of an execution; for instance, affixing the image with a rope around the neck to the gallows (hanging in effigy). This practice is not altogether extinct in Prussia and in other countries, but in England it has become merely a mode in which the populace expresses its feelings respecting an obnoxious personage, such as the English custom of parading and burning the effigy of Guy Fawkes on 5 November.

EFFINGHAM, Ill., city, county-seat of Effingham County, on a branch of the Wabash River, about 240 miles south by west of Chicago, and on the Illinois Central, the Wabash and Vandalia railroads. The city is the trading point of an agricultural region and has some small manufactories. It contains Austin College and a large photographic school. Pop. 3,898.

EFFLORESCENCE, a term applied to crystals, which, on exposure to the air, lose their water of crystallization and crumble down into a powder. The most familiar instance is that presented by the glassy crystals of washing soda, which become white and pulverulent in the air. The same phenomena is also presented by phosphate of sodium, borax and other compounds. Another application of the word is to the fine white, feathery crystallization of sulphate and carbonate of sodium which appears on porous walls, or similar crystallizations on the surface of the earth, in decomposing rocks, etc. These exudations are due to the crystallization of the saline solutions existing in the pores of the surface on which the efflorescence appears. Another use of the term is to designate the creeping up of crystals on the sides of a vessel containing a saline solution, often overrunning the edge and down the outside. This action is very noticeable with sal ammoniac as used in battery jars. Efflorescence is in some respects the opposite of deliquescence, and the difference is shown by placing an efflorescent and deliquescent body under a bell-jar. The former gives up its water, which the latter absorbs, becoming thereby fluid. See CRYSTALS.

EFFUSION (Lat. "to pour out"), in physics and chemistry, the escape of a gas into a vacuum, through a small opening (such as a pin-hole) in a thin partition. So long as the temperature of the gas is constant, the velocity of effusion is independent of the pressure. For the same gas at two different temperatures (but at the same density), the velocity of effusion varies directly as the square root of the absolute temperature. The velocities of effusion of two different gases (both at the same constant temperature) are inversely proportional to the square roots of the densities of the gases; the densities being determined by comparison under convenient but identical conditions of temperature and pressure.

EFT, the name given in Great Britain to several species of newts, especially to the common smooth newt (*Lissotriton punctatus*). The eft is very common in the ditches and ponds of Europe, especially where the water is clear. Its food consists principally of aquatic insects, larvæ, worms and mollusks. Though usually spending most of their time in the water, the young in June, and the adults in summer and autumn, become terrestrial; they appear to attain their full size the first year. See NEWT.

EGAN, Maurice Francis, diplomat; b. Philadelphia, 24 May 1852. Mr. Egan's family came to Ipswich, Mass., in 1765. His father Maurice Egan of Philadelphia, came when quite young to Philadelphia in 1825. Mr. Egan was educated by private tutors and in the Latin School of Saint Philips, at Philadelphia. He was graduated from LaSalle College — A.B. and A.M.— his doctor's degree was given to him by Georgetown University. Mr. Egan studied law under John I. Rogers in Philadelphia, but after the success of his first novel, 'That Girl of Mine' (1879) and his little volume of poems, 'Preludes' (1880), he adopted literature as a profession. He has almost 30 books to his credit, the best known of which are 'Songs and Sonnets' (1886); 'The Wiles of Sexton Maginnis'; 'Everybody's Saint Francis' (1912); 'The Ivy Hedge' and the translation of the sonnets of Jose de Heredia. Mr. Egan was professor of literature and English at the University of Notre Dame and at the Catholic University at Washington. He has been since 1907 in the diplomatic service as Minister at Copenhagen. His first diplomatic nomination was during President Cleveland's second term. He was named twice as Ambassador to Vienna, but preferred to remain at his present post.

EGAN, Patrick, American politician: b. County Longford, Ireland, 1841. He became identified with the Nationalists and the Home Rule Movement in 1871, and was one of the organizers of the Irish Land League. He was tried in Dublin in 1880 for conspiracy and sedition, going to Paris upon his acquittal. He came to the United States in 1883, and was president of the Irish National Land League of America 1884-86. He testified before the Parliamentary Commission 1889, and was instrumental in securing the failure of the case of the London *Times* against Parnell. He was appointed Minister plenipotentiary to Chile as a reward for his speeches in the campaign of 1888. In Chile his espousal of the cause of Balmaceda, the Liberal dictator, brought upon him severe criticism. Later he left the Republican party, becoming what was termed a Free Silver Democrat, and taking part in the subsequent campaigns in favor of that issue.

EGAN, Pierce (THE ELDER), English sporting writer: b. London 1772; d. there, 3 Aug. 1849. A prolific "historian of the ring" and

kindred institutions, he wrote 'Boxiana' (1818); and the widely popular 'Life in London' (1821), which was illustrated by Cruikshank. He edited in 1824 *Pierce Egan's Life in London and Sporting Guide*, which was later absorbed by Bell's *Life in London*.

EGAN, Pierce (THE YOUNGER), English novelist: b. London 1814; d. there, 6 July 1880. He was a son of the preceding. At first an artist and illustrator, he turned to fiction, winning fame with 'Robin Hood' (1840); 'Wat Tyler' (1841), and similar conceived romances; while his later and more sensational tales, 'Imogen'; 'Fair Lilias'; and others, appeared for the most part as serials only.

EGAÑA, Juan, hoo-ān' ā-gā'ña, Chilean author and statesman: b. Lima 1769; d. Santiago, Chile, 13 April 1836. After being graduated from the College of Santo Toribio, he was made professor of philosophy at the age of 16; and at 21 succeeded to the chair of theology and law. He practised the latter profession at Santiago and was chosen to the professorship of oratory at San Felipe. He took an active part in the revolution, was a member of the first Chilean Congress, was captured and imprisoned on Juan Fernandez Island, but was liberated in 1817, after which he was made professor of literature at the National Institute and a member of the Board of Education. He was again a member of Congress until elected President of the Republic in 1823. He was a voluminous writer, both of poetry and prose, his works including several educational textbooks. He exercised great influence in shaping the character of the people and the policy of Chile. He published a translation of his own work in English under the title of 'Pehuenchan Letters' (1819).

EGBERT, king of Wessex: b. about 775; d. 837. On the death of Alcmund, the former king, Brihtric, a powerful noble, succeeded in ousting Egbert, who had the best claim to the throne, and was compelled to take refuge first in the court of Offa of Mercia, then in that of Charlemagne. On the death of Brihtric he succeeded him as king of Wessex, in 800. He reduced the other kingdoms, and rendered them dependent on him in 827, and is thus considered the first king of all England. He was defeated by the Danes in 835, but reconquered them in 837. Consult Green, 'The Making of England' (London and New York 1881).

EGBERT, James Chidester, Roman archæologist and epigraphist: b. New York, 3 May 1859. He was graduated at Columbia University in 1881, and held a prize fellowship (1882–85). He began to teach in the university in 1885 and was adjunct professor of Latin 1885–90. In 1890 he was appointed professor of Roman archæology and epigraphy in Columbia, and has done much to promote the study of these special subjects. He has published 'Introduction to the Study of Latin Inscriptions' (1895); and has also edited 'Cicero de Senectute' (1895) and written 'Macmillan's Shorter Latin Course' (1892); 'Livy XXI and Selections from XXII to XXX' (1913). Professor Egbert was appointed director of the summer session at Columbia University in 1902 and subsequently directed the extension lectures of the same institution.

EGEDE, ā'gĕ'dĕ, **Hans,** Danish missionary, termed the apostle of Greenland: b. Harstad, Norway, 1686; d. Falster, Denmark, 1758. In 1707 he became a preacher at Wogen. Having heard that Christianity had been once established in Greenland, but had become extinct in the country for want of teachers, he resolved to visit the country, and to preach the gospel to the inhabitants. Having received from the Danish government the title of royal missionary to Greenland, with a small pension and three ships, he sailed on 21 May 1721 with 46 persons under his command. Egede landed on 4 June, and the conversion of the Greenland Eskimos was now undertaken, but offered great difficulties. Egede took up his residence with his two sons among the natives, in order to learn their language, and so be able to carry out his project of conversion. He carefully noted down every word of which he discovered the meaning; often performing long journeys, at the peril of his life, to visit the remotest Greenlanders, for the purpose of gaining their confidence, in which he succeeded by a thousand acts of kindness. He succeeded in winning many converts, established trade relations with Denmark and founded the colony of Godthaab. After spending 15 years in Greenland, amid innumerable discouragements, he returned in 1736 to Copenhagen, to make new exertions for the support of Christianity in that country. For this purpose a seminary was founded at which missionaries were trained for work in Greenland. He served as principal of this school for six years. The government appointed him director of the Greenland missions, and established his son Paul in the office of missionary there. His writings are in Danish, and relate to the natural history of Greenland, and his sufferings and adventures there.

EGEDE, Paul, Danish missionary: b. 1708; d. Copenhagen 1789. He was a son of Hans Egede and was his assistant from the time he was 12 years old. Notwithstanding a strong inclination for the naval service, he submitted to the wishes of his father, studied divinity, joined the mission in Greenland in 1734, and remained there till 1740. He then returned to Copenhagen, and afterward was appointed bishop of Greenland. We have from him an 'Account of Greenland,' extracted from a journal kept from 1721–88; 'Dictionarium Grœnlandicum'; 'Grammatica Grœnlandica'; and translation of the Gospels, the 'Imitation of Christ,' etc., in the Greenland tongue.

EGELHAAF, ā'gĕl-hāf, **Gottlob,** German historian: b. Gerabronn, Würtemberg, 1 March 1848. He has published 'A History of Germany During the Reformation' (3d ed., 1893); 'Emperor William' (3d ed., 1888); 'A History of Germany During the Sixteenth Century until the Peace of Augsburg' (1888–92); and other works.

EGER, ā'gĕr, Bohemia, town in the northwest, on a rocky eminence above Eger, 91 miles west of Prague. It was once an important fortress, founded in the 12th century. Six lines of railroads converge at Eger. There are various industries, including machinery, wool, cotton and leather manufactures, and a flourishing trade. The celebrated Wallenstein was assassinated at the Stadthaus here (1634). Franzensbad, a watering place, is connected

with Eger by an avenue three miles long. There is an interesting ruin of a castle built by Frederick Barbarossa; and the inn in which Schiller wrote his 'Wallenstein' is still standing. Pop. of the commune about 25,000.

EGER, a river which rises in Bavaria, in the Fichtelgebirge, 12 miles northwest of the town of Eger, flows first southeast, then takes a northeasterly direction into the Elbe, near Leitmeritz in Bohemia, after a course of about 190 miles.

EGERIA, ē-jē'rĭ'ą, (1) a nymph who received divine honors among the Romans. Her dwelling place was near the Porta Capena, Rome, where a grove was consecrated by Numa to the kindred Camenæan goddesses. Numa is said to have had secret conversations with her and to have received from her the laws which he gave to the Romans. Some say Egeria was the wife of Numa. (2) A genus of spider crabs of the family *Maiidæ*; (3) a genus of bivalve shells of the family *Donacidæ*; (4) in astronomy the thirteenth planetoid, discovered by De Gasparis at Naples (1850).

EGERTON, ĕj'ĕr-tŏn, **George** (psuedonym of MRS. MARY CHAVELITA DUNNE MELVILLE CLAIRMONTE BRIGHT), English novelist: b. Australia, 14 Dec. 1860. She was married in 1888 to H. Melville, who died in 1889; in 1891 to Egerton Clairmonte, who died in 1901; and in 1901 to R. G. Bright. She has published 'Keynotes' (1893); 'Discords' (1894); 'Young Ofe'se Ditties' (1895); 'Symphonies' (1897); 'Fantasias' (1898); 'The Wheel of God' (1898); 'Rosa Amorosa' (1901); 'Flies in Amber' (1905); and several plays and adaptations.

EGERTON, Hugh Edward, English historian: b. 19 April 1855. He was educated at Rugby and at Corpus Christi College, Oxford. In 1885 he was assistant private secretary to the Hon. E. Stanhope, M.P., and from 1886 to 1906 he was a member of the managing committee of the Emigrants' Information Office. In 1905 he was appointed Beit professor of colonial history at Oxford. His publications include 'A Short History of British Colonial Policy' (1897; 4th ed., 1913); 'Sir Stamford Raffles' (1900); 'Origin and Growth of the English Colonies' (1902); 'Canada under British Rule' (1908); 'Canadian Constitutional Development,' with W. L. Grant (1907); 'Federations and Unions Within the British Empire' (1911); an edition of 'Sir W. Molesworth's Speeches' (1903), and of the 'Royal Commission on Loyalists' Claims 1783–85' (1915). He contributed to Palgrave's 'Dictionary of Political Economy,' Poole's 'Historical Atlas of Modern Europe,' 'Cambridge Modern History' (Vols. IV and IX), 'The Oxford Survey of the British Empire,' 'The American Cyclopædia of Government,' *English Historical Review* and other publications.

EGG, Augustus Leopold, English genre painter: b. London, 2 May 1816; d. Algiers, Algeria, 26 March 1863. He became a contributor to the Academy exhibition in 1838 and was elected a member of the Royal Academy in 1860. He painted a great number of pictures illustrative of humorous scenes from Shakespeare, Le Sage and Walter Scott.

EGG. The fundamental cell, technically called the ovum, from which each individual living animal of every species is developed. The egg is the product exclusively of the female organism. It may or may not be developed into another individual being, but the potency of such development is inherent in the egg. It is not to be understood, however, that a single egg may develop into but one individual. In many known instances the single egg divides and subdivides before it reaches the stage of developing the individual, so as to produce from 8 to 16 individuals — as in *Aurelia*; or even 32 individuals — as in varieties of *Natica*. Segmentation previous to individual development has been observed also in the frog, the rabbit, the guinea pig, the dog and the deer, as well as in some birds, reptiles, fishes and lower animals.

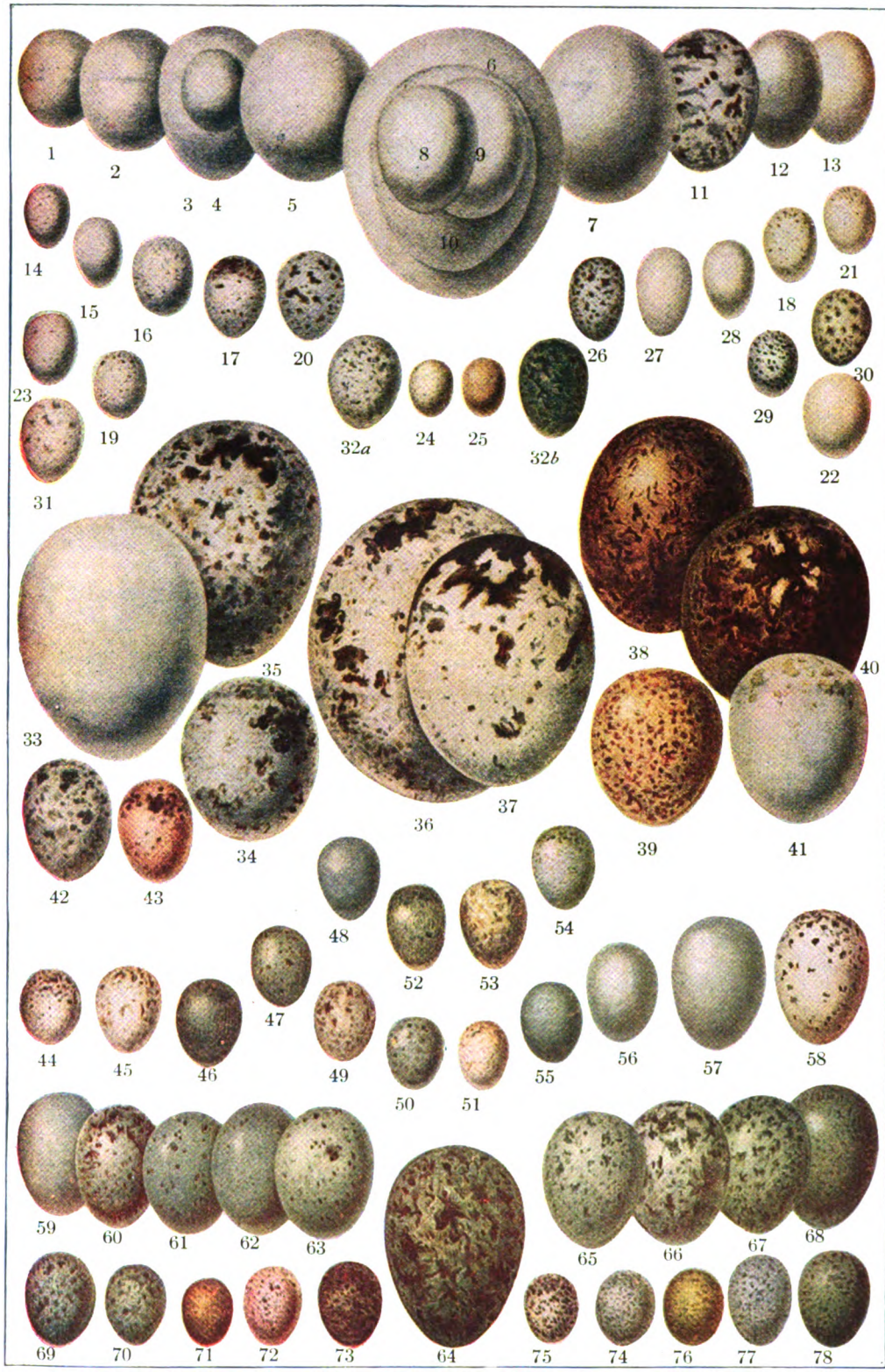
So far as minute observation goes all eggs of every species are alike in structure and composed of the same primary elements, and at the beginning develop by the same processes of growth. There comes a time, however, in this progressive growth when each egg assumes a character peculiar to the species to which it belongs in the scheme of animated nature. The egg-cell has a constant form of structure. There is an outer sac of cell wall containing a spongy network, filled with a more or less transparent fluid, in which is suspended an interior sac known as the nucleus, filled with a different network and a clearer fluid, and within this the germinal "dot" or "spot" called the nucleus. As the purpose of this article is the discussion of the production of the egg the reader is referred to the article EMBRYOLOGY for the consideration of the processes by which the egg is developed into the specific animal.

Animals in which the egg passes out of the body before it is hatched, that is, before the maturity and escape of the embryo, are said to "lay eggs," or to be "oviparous"; those in which the egg remains inside the body to hatch are called "ovoviviparous"; those whose eggs are retained in connection with the parent by means of a placenta and an umbilical cord, so that the young are brought forth alive, are called "viviparous." These distinctions, and especially the first two, are of secondary importance, and in some cases it is difficult to classify an animal according to them; or varying conditions may lead to change in the same species or individual at different times. In practically all the mammalia the egg after being produced by the ovary attaches itself to the body of the mother and is developed directly by the vital processes of her system. The only exceptions are a few lowly mammals (the *Monotremes*, q.v.). All birds and most other animals "lay" their eggs. The ovoviviparous ones are to be found chiefly among reptiles and fishes. The production of eggs by an individual female varies within the limits (so far as known) of one at a time, as in the human race; the horse, cow and many other species of animal; the penguins and many other seabirds; to the 9,000,000 laid by the cod and 14,000,000 laid by the turbot. Science has offered an explanation of this great disparity in egg production by advancing the theory that as the object of the egg is the perpetuation of the species the number of eggs produced corresponds to the natural danger of destruction of

EGGS.

1. Kingfisher
2. Bee-eater
3. Black Woodpecker
4. Spotted Woodpecker
5. Roller
6. Eagle Owl
7. Long-eared Owl
8. Short-eared Owl
9. Pygmy Owl
10. Brown Owl
11. Nightjar
12. Hoopoe
13. Black Martin
14–19. Titmice
20. Nuthatch
21. Tree-creeper
22. Wryneck
23. Wren
24–25. Kinglets
26–28. Swallows
29, 30, 31. Warblers
32. Cuckoo
33. Goshawk
34. Sparrowhawk
35. Kite
36. Eagle
37. Osprey
38. Peregrine Falcon
39. Kestrel
40. Honey Buzzard
41. Marsh Hawk
42–43. Butcher-birds
44. Crested Titmouse
45. European Robin
46. Persian Nightingale
47. Bluethroat
48. Hedge Sparrow
49–51. Flycatchers
52. Whitethroat
53. Blackcap
54. Stonechat
55. Whinchat
56. Wheatear
57. Starling
58. Oriole
59. Rock Thrush
60. Fieldfare
61. Song Thrush
62. Ring Ouzel
63. Mistle Thrush
64. Carrion Crow
65. Jackdaw
66. Alpine Chough
67. Magpie
68. Jay
69–71. Reed Wrens
72. Garden Warbler
73–74. Pipit Lark
75. Grasshopper-Warbler
76–77. Wagtails
78. Skylark

EGGS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either the eggs or the young in the particular environment of each species. This theory seems well established by the observed facts, but it is evident that nature in so providing for the continuance of all her living creatures failed to take into account the depredations of man. It is easy to mention a dozen species which have suffered complete extinction within historic time because their reproductive functions were not gauged to make good the wholesale nest robbing and slaughter perpetrated by the human species.

Eggs of Birds.—The eggs of birds are so much more in evidence than those of other living creatures that it seems the natural procedure to discuss them as first in order.

The eggs of birds are larger in proportion to the size of the mature parent than is the case with any other division of the animal kingdom. This peculiarity has been "explained" by saying that the bird "must be" hatched at an advanced stage of development and therefore much food for it while it is growing "must be" stored within the shell of the egg, and that for this the comparatively large space is required. The matter is mentioned here only to point out that the statement of these facts does not constitute a "reason" and also to remark that no reason is necessary — it is the normal fashion of development for the bird; that is all there is to it. The egg of a bird originates in the ovary of the female parent. At the very beginning of its course toward the oviduct it is surrounded with a larger or smaller envelope of yolk. Chemically this is an emulsion containing varying percentages of fat, lecithin, lutein (the coloring matter), cholesterol, the phosphoprotein vitellin and a small quantity of the coagulable protein livetin. The vitellin and lecithin are in some form of combination and are generally joined (for discussion) under the term lecitho-vitellin. This yolk lies in concentric layers about the whitish germinal vesicle or "tread" of the egg, which is the protoplasmic part where alone development proceeds. This vesicle floats on the surface of the food-yolk and remains on top by reason of its lightness no matter how the egg is turned. The eggs of many of the lower animals contain food-yolk, but it is usually colorless. The egg of a hen or other bird is further furnished with layers of albumin (the "white") placed upon it in the narrow upper part of the oviduct. Chemically the white of the egg is a coagulable protein fluid of a slightly yellowish tint enmeshed within a network of fibrinous matter. It is feebly alkaline and is 85 to 86 per cent water. Of the solid matter 12.2 per cent is protein — mostly albumin, with smaller proportions of egg-globulin and ovo-mucoid,— glucose 0.5 per cent, inorganic salts 0.66 per cent and traces of fat, lecithin and cholesterol. Outside of this there is next deposited upon the albumin a fibrous membrane in two distinct layers (the "egg-pod"), the separation of which later forms the "air-chamber" at the end of the egg where the head of the chick lies. The stages of advancement to this point occupy a period of about four hours. In a further stage of the descent along the oviduct there is deposited in and upon the egg-pod an external covering or "shell," calcareous in various degrees. The process of depositing the shell occupies 18 to 20 hours. This shell is porous so as to admit air to the embryo, which also exposes it to bacteria so that eggs are liable to quick decay when living influences cease to operate within it.

Eggs of birds differ greatly in size, color and markings, and this is true even as to different birds of the same species. Although the yolk of the egg is spherical the outer shell is rarely so. It ranges from nearly elliptical or ovoid to a shape almost conical, known as conoid. It is to be noted that eggs which are laid in exposed places, on rocky ledges or on the bare ground, are much more sharply pointed than those which are laid in deep nests or in holes in trees, and this goes to bear out the theory that the shape of eggs is protective — to prevent their rolling away from the nest. In color as a rule they are white, but many are tinted with cream, pink, blue, green or brown, and they may be plain or spotted, speckled or blotched. These blotches and markings are of varying colors and sometimes of several colors on the same egg. They are deposited in the shell of the egg by certain pigment ducts active as it is making; and while the eggs of the whole species have a close general resemblance, so that an ornithologist recognizes them at once, the eggs of individual birds of the species have an individuality of markings. There is often to be observed a double spotting, as if a second layer of shell with another system of spots had been deposited outside of a first layer. It has been suggested that the theory of protective coloring will not fully explain these markings, and that the individuality of their patterns should be ascribed rather to the fact that it affords the mother-bird opportunity for instant recognition of her own nest. The widest variation in this respect has been noted as to the guillemot, 30 distinctly different patterns of markings being shown in some collections. It has been observed also that the markings on the eggs of birds in captivity vary with the state of health and as to conditions of mind, as fear, anger and the like. It is notable that eggs which are laid in dark places are as a rule without markings. It is to be expected as a matter of course that eggs would differ in size just as do the parent birds. A novice in the study of bird lore, however, is not prepared for the wide disparity in *relative* size when the eggs of different species are compared. The smallest egg known among birds is that of the humming bird, the smallest of the birds. This is quite as one would expect. But the cuckoo lays an egg which is but one-fifth of the size of that laid by the jackdaw, although the two parent birds are of the same size. The mature guillemot is about the same size as the raven, but its egg is three times larger. The egg of the New Zealand wingless bird, the kiwi, has a prodigious weight, fully one-fourth that of the parent, while the egg of the ordinary barnyard hen, which may be taken as typical, weighs about one-thirtieth as much as the adult fowl. The largest known bird's egg is that of the now extinct epyornis of Madagascar, which was 10 inches in its smallest diameter. The largest egg of species now in existence is that of the ostrich. Variations in the size of eggs, moreover, may occur in the same species in a different habitat. Thus the eggs of the great white heron in Europe are 40 per cent larger than those of the same species in India.

The number of eggs laid in each clutch is constant for the individuals of the same species, but differs widely for different species. Many of the sea-going water birds lay but one egg a year — occasionally two. Those waterfowl classed as game birds lay from 10 to 14. The song birds and field birds generally lay four or five eggs in each clutch, but some few species do not lay more than two (as the pigeon) or three, while a few lay more — up to 10 or 12, or even 20, as is the case of the common partridge. Where two broods are raised in a year, of course the yearly production is doubled; and this, too, may happen in the case of birds which commonly rear but one brood, if the first nesting is destroyed by accident or otherwise. In several cases on record birds have laid the regulation clutch number again and again until exhausted, in the persistent endeavor to raise the yearly brood. The case of the common hen is in point: under natural conditions she would raise two broods of chicks during the year, from 13 to 15 eggs at a time. But under the exploitation of the poultryman, who removes the eggs from day to day, she continues laying for months at a time, producing up to 200 eggs per year.

Notable differences are found also in the texture and relative thickness of the shells of birds' egs. Some are so highly burnished as to resemble polished metal — as the tinamous. The eggs of kingfishers and of some woodpeckers are glossy; those of ducks are waxen in appearance. Some are chalky and others are coated with a chalky crust of a different color from the hard smooth shell underneath — as with the cormorants and gannets, in which the egg is blue and the incrustation white. The shell of the ostrich's egg has the pecularity of being deeply pitted. Reference to the accompanying plate will give a clearer idea of the principles cited than can be conveyed by mere explanation. See also Eggs.

Eggs of Reptiles.— Reptiles, like birds, are distinctly oviparous, with few exceptions. Their eggs are, however, hatched by the heat of the sun, or of the fermentation of decaying vegetable matter. In the few exceptional instances referred to the young break out of the eggs as soon as they are laid, and in at least one instance — the stump-tailed lizard of Australia — the young complete their development and leave the eggs before they are laid. Among the snakes, too, most of the boas bring forth their young alive, and so do some of the deep-sea snakes. An exception is to be noted in the case of the python, which lays from 15 to 100 eggs at a time and broods them until the young emerge.

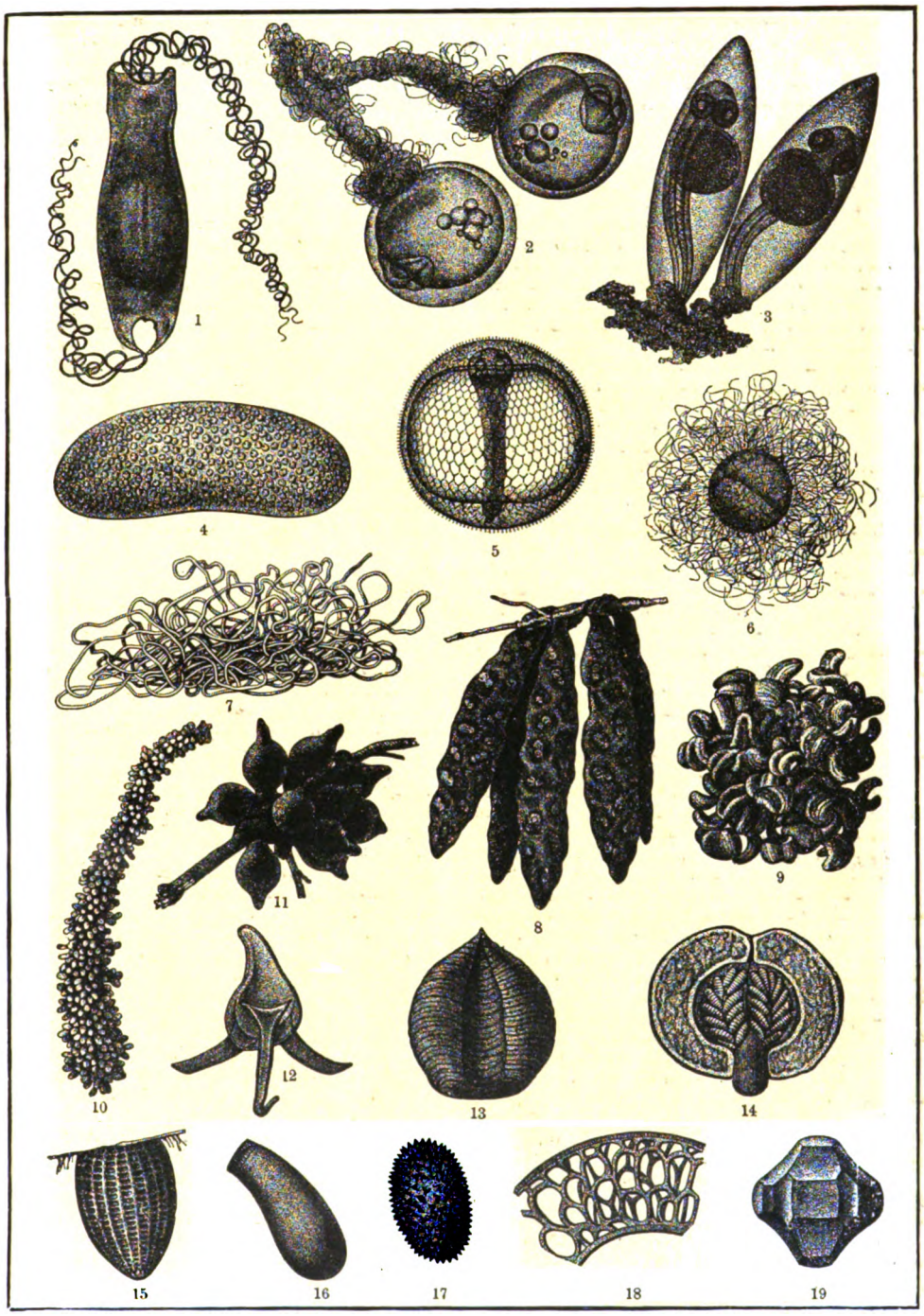
The eggs of reptiles differ from those of birds in two respects — they are without a calcareous shell, having a parchment-like skin instead, and in shape they are spherical or elliptical, not ovoid nor conoid. In size they are much smaller proportionally to the parent than is the case with the birds. The egg of the crocodile, for example, is about as large as that of a goose. Those of the giant tortoises of the Galapagos are spherical and about the size of hens' eggs, and in contrast to those of other reptiles have hard calcareous shells. Crocodiles as a rule lay their eggs in sand, in some cases digging out a pit two feet deep and depositing the eggs in two layers, with sand in between. The whole "nest" is then smoothed over and left to the sun's heat for hatching. The mother crocodile not infrequently digs up the eggs a day or two before they hatch, excited thereto probably by hearing the young piping in the shells. Sea turtles lay their eggs in holes scraped out of a sandy shore well above the reach of high water. The number laid sometimes reaches 100, and they are carefully covered with sand. The eggs of marine turtles are generally esteemed as food in the countries where they are plentiful.

Eggs of Amphibia.— Among the frogs and toads the eggs are spherical, with a thin membranous envelope, in which the embryo is distinctively visible surrounded with the yolk and with one or two outer coatings of a gelatinous substance. The latter is not noticeable when the eggs are first laid, but as they are laid in water the gelatinous substance swells into a relatively thick layer of slippery, non-soluble jelly. The eggs vary in size from one-twenty-fifth of an inch (with the ordinary toad) to nearly one-half an inch in diameter with the *Megalophrys longipes* of the Malay Peninsula, the eggs of which are not laid in water but hid in damp moss, the little frogs emerging in a condition of complete development. The number of eggs laid by those frogs and toads which lay them in shallow pools is very large, reaching 12,000, and, as might be supposed, the destruction of these unprotected eggs in enormous. Some species of tree-frogs lay their eggs in a mass of froth on the leaves of branches which overhang a pool. When the young hatch out they drop into the water to complete their development. These frogs lay about 200 eggs at a time. A small New Guinea frog lays 12 to 18 eggs enclosed in a small elliptical sack which is set adrift in the waters of a running stream. Several of the toads and frogs are noted for carrving their eggs about with them, in the water or on land, as the case may be, until they hatch.

Among the tailed batrachians, which include the animals popularly called "lizards" and more correctly, newts and salamanders, the aquatic species lay their eggs in water. They are deposited one in a place, or in small clusters, and generally attached to water-weeds or bits of wood or stone on the bottom of the pool. The land varieties lay their eggs in a damp hole in the ground or in a hole in a tree trunk, sometimes as high up as 30 feet above the ground. The eggs are spherical for all species and generally about one-fourth of an inch in diameter. The giant aquatic salamander of Japan and China lays up to 500 eggs, which are in several separate clusters, the members of each being connected together by a membranous "string." This same peculiarity has been noted in the case of a small water salamander common in the streams of the eastern United States. There are, however, quite a number of species of these animals which do not lay eggs but bring forth their young alive.

Eggs of Fishes.— Most species of fish are oviparous, some are viviparous and a few ovoviviparous. Owing to the obvious difficulty of observing animals whose habitat is deep water, there are many species about which nothing is known concerning their modes of reproduction.

EGGS OF FISHES AND LOWER ANIMALS



1 Egg of Shark
2 Egg of Cristiceps
3 Egg, with embryo of Goby
4 Spawn of parastic Fierasfer
5 Egg with embryo of Stargazer
6 Egg of Garfish
7 Spawn of a nudibranch
8 Spawn of Squid
9 Spawn of Sea-snail
10 Spawn of Octopus
11 Egg of Cuttlefish
12 Egg of a flat-worm
13 Egg-capsule of Mantis
14 The same in cross-section
15 Egg of a butterfly
16 Egg of Bedbug
17 Egg of Beetle-mite
18 Structure of eggshell of a phyllopod crustacean
19 Egg of branchipod crustacean

Most of the shark-like fishes are viviparous, but in those cases in which they do lay eggs the latter are of considerable size, and, as with the common ground dog-fish, they are provided with a "shell" of tough, horny structure. Within this is found a yolk surrounded with an albuminous layer, so that there is a close resemblance to the eggs of birds. The shell of the dog-fish egg is quite a well-known seashore object, with its oblong cushion shape and the long spinous hooks at each corner. It is only in fishes of this class that an envelope worthy of the term "shell" is produced. The eggs of other fishes have only a thin membranous covering, although in some cases this is hard to a degree and often adhesive, fixing itself to the first solid object that it comes in contact with. A few species lay their eggs on rocks or in clumps of weeds between high and low water, so that they are exposed to the atmosphere twice a day by the fluctuating tides. Others, among which are some of our common catfishes, lay but a few eggs and carry them around in the mouth until they are hatched. Reference has already been made to the great fecundity of the cod and turbot. In the same classification belong the salmon, shad and herring and many others who come up from deep water to lay their eggs in a wholly unprotected condition in the shallow shore or inland waters. The eggs of the herring, like those of the perch, are adhesive, and in this respect have a certain advantage against destruction. Most of the deep-sea fishes, however, lay egg-masses which are buoyant and float about on the surface subject not only to the appetites of other dwellers in the sea but also to those of sea birds, so that comparatively few eventually reach maturity.

The eggs of several kinds of food fishes are esteemed as food delicacies, notably the roe of shad and herring, and caviar (q.v.) made from the eggs of sturgeon and other fish.

Eggs of Insects.— When it is recalled that there are upwards of 300,000 known species of insects it will readily be seen that no befitting mention of the well-nigh innumerable variations in egg production and egg forms can be attempted within the necessary limits of this section. The student must be referred to the appropriate volumes noted in the bibliography below.

Most insects are oviparous, but within a few species the eggs are hatched within the body of the mother. The number of eggs laid as a "brood" ranges from one or two up to thousands. As a rule the number laid by the commoner insects is from 100 to 300. They are laid generally in groups of detached eggs or in small masses, though often singly, and attached to a leaf or twig of the plant which will furnish suitable food to the newly-hatched larva. The habits of bees and wasps in this respect are well known, and it needs only this passing mention to bring to mind the combs of wax or paper or the mud cells in which these insects lay their eggs and raise their young. The cluster of eggs rolled up in silk by the common house and garden spiders is a familiar sight.

Undoubtedly the eggs of the butterflies and moths are the most interesting of all among the insects. They are very small, and within the outer membranous coating they contain the egg-cell and a supply of liquid food for its development. In form there is the greatest possible variety — globular, thimble-shaped, pear-shaped, cylindrical, purse-like, lens-shaped, turban-shaped and a multitude of other forms for which no simile can be found. Under the microscope they exhibit a wonderful variety of flutings, sculpturings, lacework and other forms of decorative surfaces. Although most of them are white or greenish their colors range into cream, yellow, red, blue and brown. Generally but one laying is made, but there are a few species which produce two or even three broods in the season. In tropical countries there may be several more than this during the longer life of the adult females.

Eggs of Crustacea.— The eggs of the crustacea are notable as containing a larger quantity of yolk in proportion to their size than do those of any other animal. In nearly all species the eggs are carried around by the female during the early stages of their development, either attached to some portion of her body or in a brood pouch. They do not always hatch into the complete form, but may advance, like many of the crabs, by changes with each moulting of the shell to the final adult form. With this large measure of protection the number of eggs laid as a "brood" is generally few.

Eggs of Mollusks.— As a rule the mollusks are oviparous, but there is a considerable number, among them many of the land and fresh water snails, which are ovoviviparous. The number of eggs laid at a time varies greatly. *Helix aspersa* lays from 40 to 100 in a little depression hollowed out between the roots of a tuft of grass and covers them with earth. The oyster lays from 300,000 when young to 60,000,000 when a full-grown adult. These eggs are almost microscopic in size, and they are devoured in thousands by fish and other marine animals. Some of the tropical mollusks lay eggs as large as those of pigeons, but with a "shell" of tough membrane without a lime deposit to harden them. One of the peculiarities of egg production among the mollusks is their fashion of laying them in small clusters in capsules or egg-pods. These capsules are usually joined together in curious ways by fibrous bands or strings or ribbons, which sometimes are three feet in length and in others are an inextricably tangled snarl. One of the most curious of all is the cochlostyla of the Philippines, which lays its eggs in a folded leaf at the tops of the highest forest trees. For an intimate study of this most interesting section of animal life the books mentioned below are of advantage.

Eggs of Lower Animals.— Among the higher worms may be mentioned the leech, which burrows into the soft mud above the level of the edge of the pool in which it lives and lays several eggs with yolks in a capsule. The tiny leeches upon hatching find their way instinctively out of the burrow and into the water. The tapeworm develops a clutch of eggs in each of the lower joints of its long body. As the eggs approach the larval stage the joints break loose and become simply egg-pods, similar to those of the mollusks. Many of the lower worms lav eggs which are relatively large and are protected by an enveloping capsule. The starfish and sea-urchin pass their eggs out through pores at the base of the arms

or spines, and there they are held in small hollows between the armor plates until they are so far developed that they push themselves loose of their own accord and swim off independently. The egg production of the crinoids is similar, the eggs being retained within the body cavity until they have reached the larval form, when they are released. The ophiuroids carry their eggs about with them in a pouch, where the young develop. In the sponge the egg forms in a cell within the body and undergoes considerable development, so that at the time when it is thrown off by the parent body it has become a larva capable of independent existence.

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EGG INDUSTRY. From an economic point of view eggs constitute one of the most important commodities in commerce, and the egg industry, both in the production and distribution, is of notable proportions. Although eggs are used to some extent in the arts, it is as an esteemed food product that they maintain their importance.

In the United States the egg industry is continually growing. Formerly this country relied largely upon importation for its supply of eggs, but now it exports far more of them than it obtains from foreign ports. The increasing use of incubators has led to a large increase in the number of eggs laid by native fowls, which need "no longer waste their time in hatching them, but may devote it to the more profitable labor of producing them." It is said by experts in this branch of American industry that although the number of fowls kept in this country is now relatively smaller than formerly, yet by the adoption of labor- and time-saving machines there has been a constantly increasing output of eggs.

The production of poultry and eggs is one of the most profitable industries. A statistician of authority estimates that a hen may realize 400 per cent of profit for her owner. In 33 States and Territories the value of eggs exceeds the value of the poultry product. The egg product in the United States amounts to more, when measured by dollars and cents, than the combined gold and silver production.

According to the figures of the 1910 census, taken for the year 1909 (the latest so far compiled for this industry), the total production of eggs for that year as reported from 4,883,507 farms (out of the 6,361,502 farms at that time in the United States) amounted to 1,457,385,772 dozen, valued at $281,157,980. Of the entire production only 926,465,787 dozen (63.6 per cent) were sold on the market, the remainder being consumed on the farms or used in hatching. Among the several States, Missouri held the lead in market production, selling a total of 71,886,145 dozen. Iowa was second, with a market production of 70,835,349 dozen. Then followed in the order of their contributions to the grand total: Ohio, 69,575,637 dozen; Illinois, 62,036,857 dozen; Indiana, 53,899,416 dozen; Kansas, 52,833,166 dozen; Pennsylvania, 52,446,077 dozen; New York, 48,074,481 dozen; Michigan, 38,568,386 dozen; Minnesota, 34,347,776 dozen; Wisconsin, 32,268,836 dozen. These 10 States produced nearly three-fifths of the entire output of the country.

The average value per dozen of the 1909 egg production was 19.3 cents. They were cheapest in Texas (15 cents); Oklahoma and Arkansas (16 cents); Louisiana, Kentucky, Tennessee, Nebraska, Kansas and South Dakota (17 cents); and dearest in Arizona, Nevada and Massachusetts (30 cents), and Rhode Island and Connecticut (29 cents). The average prices in 1917 ranged from 28¼ cents in March to 56 cents in December in the New York market, and from 24½ cents to 43 cents in the Saint Louis market. The average wholesale prices all over the country in 1917 varied from the low of 14 cents in Alabama, Arkansas and Texas, and of 28 cents in Massachusetts, Connecticut and New Jersey for April to the high of 30 cents in Alabama and 63 cents in Rhode Island for December.

By far the larger percentage of eggs used for food are those of the hen. There are, however, a considerable and constantly increasing proportion of duck eggs on the market and a few goose eggs. The average hens' eggs weigh 24 ounces to the dozen, and as food it is customary to regard a dozen eggs as equivalent to a pound of lean beef. This is a very close approximation with the balance somewhat in favor of the eggs. A dozen duck eggs weigh 30 to 42 ounces, and a dozen goose eggs about 80 ounces. Pound for pound, eggs contain the same amount of fat as beef, and about half as much protein but being more digestible when properly cooked, their food value cannot be gauged exclusively by their chemical constitution. The yolk of the egg is the more nutritious portion, containing all the fat of the egg and the important phospho-proteid lecitho-vitellin. The white is chiefly albumen and water. In the general make-up of the egg the shell constitutes about one-tenth, the yolk about three-tenths and the white six-tenths. The yolk and white taken together, as ordinarily eaten, show a composition of proteids, 13.5 per cent; fat, 10.8 per cent; water, 73.8 per cent, and mineral salts, 1.6 per cent. The eggs of ducks and geese have a higher fat content, reaching 14.5 per cent, with a correspondingly smaller percentage of water. When fresh, eggs have a specific gravity between 1.08 and 1.09, growing slightly less day by day when kept in the open air; so if an egg sinks in a salt solution of 1.07 specific gravity the egg is fresh.

Preservation.— Eggs freshly laid will retain their fine qualities for several days if kept in a cool place. The nearer this temperature approaches 40° F. the better, for eggs which have been fertilized develop a certain amount of internal heat due to the vital processes which are beginning, and a low temperature is necessary to halt these changes. For this reason unfertilized eggs, if they can be had, are

much easier to keep in perfect condition. Where eggs are to be preserved for long periods cold storage offers the most effective method, but beyond a certain limit — from five to six weeks at the longest — the fresh flavor cannot be retained. In ordinary household preserving the customary methods are in the line of filling up the pores of the shell in such a way that bacteria-laden air cannot enter and set up fermentations. They are usually rubbed over with butter, lard, gum-water, etc., or, which is still better, they are placed in layers, small end down, in very dry ashes or fine dry salt, packed in tubs and boxes and put in a dry, cool place, protected from severe cold in winter. A slightly more expensive but a highly recommended plan is to dip the eggs into a solution of silicate of soda, or "water glass," allowing them to drain until dry, before packing in salt. If the dipping is thoroughly done, the salt packing may be dispensed with. An alternate method is to pack the eggs closely in an earthen jar or crock and pour over them the silicate solution, allowing them to remain in the solution until used. The proportion in which the solution is made up is one part of the "water glass" as obtained from the druggist to 10 parts of water for the dipping process or to 12 parts of water where the eggs are kept in the solution.

Marketing.— It is estimated that the losses in marketing eggs in the United States amount to not less than $50,000,000 a year. This enormous loss is nearly all due to carelessness in the first handling — that by the producer. In a lot of 706,000 eggs bought recently in Kansas, more than 66,000 eggs were what are called in the egg trade "rots"; that is, they were bad when sold by the farmer — carelessly gathered, perhaps from long abandoned nests, or improperly kept after gathering, or kept too long before selling. Further losses on this one purchase of eggs, mostly through thin shells, which broke in transport, brought the total loss up to 14.3 per cent of the amount paid for the lot. Obviously nine-tenths of this loss could have been avoided with proper care. Such experiences have led to the establishment of a trade rule among merchants who buy eggs in quantities for shipment that they are to be paid for "loss off"; meaning that no eggs which come under the classifications of "rots," "spots," "blood rings," or "leakers,"—terms which explain themselves — shall be paid for. This rule, where enforced, has already operated to reduce materially the number of bad eggs in consigned shipments.

The considerably larger price commanded by really fresh-laid eggs in most markets has stimulated marketing in several channels outside of the regular commercial routine. One of the most successful of these plans has been the marketing through creameries. The farmer who delivers milk or cream daily or semi-weekly, as the case may be, may without any extra labor deliver the surplus eggs raised on his farm within a day or so of their laying. The creamery, gathering from many farms, can ship daily an egg product of the highest market value. The cost of such handling in connection with the regular business of the creamery has been proved to be not above one cent per dozen eggs shipped. In other localities where creameries do not exist, associations known as "Community Egg Circles" have been formed especially for this co-operative shipping of strictly fresh eggs, bringing their members from five to eight cents per dozen above the current prices for ordinary trade eggs.

Another avenue open to the individual producer is the parcel post. Eggs packed in containers approved by the Post Office Department can be sent direct to the individual consumer and the highest prices realized. Some of these approved containers are substantial, and may be returned empty at a nominal cost and so used many times, distributing their first cost over several shipments. However, the special package need not be used if the eggs are securely packed with excelsior, or other similar material, in strong baskets or boxes.

Eggs are also marketed in bulk after being broken, either in the liquid form or in a powder after drying. These methods are in use where very large supplies of eggs are produced at a long distance from the point where they can be sold at a reasonable profit, and where the probability is that they would suffer a serious loss through breakage during transport. In the preparation of eggs for this method of marketing the utmost care must be taken that they are not contaminated by any dirt in the process of breaking. When the cans are full they are frozen, and in this condition are transported and delivered to the consumer — generally some large wholesale cake-baking establishment. In some instances borax is added to the liquid eggs as a preservative, but this is highly objectionable where they are to be used as food. These liquid eggs are also used in certain leather dressing processes. The drying and powdering of eggs is done by forcing the liquid eggs through tiny apertures in a plate into a drying chamber at such temperature that the egg spray is dried to the condition of meal before it reaches the collecting tray at the bottom.

Cooking.— The cooking of eggs has the effect of rendering their valuable proteins more or less indigestible, according to the degree of the cooking. While this is largely a matter of indifference to the person in good health, it is often of some importance to an invalid or convalescent. In the latter event the less cooking the better. Many times the egg is simply beaten up, perhaps with the addition of wine, and eaten raw. Another approved method of preparing eggs for persons of delicate digestion is to "jelly" them by pouring a quart of boiling water upon an egg or two and letting the vessel stand on the back of the stove where it will keep hot but not boil. In about 10 minutes the egg will be turned into a soft semi-transparent jelly, in which condition all its protein is readily assimilable.

Poisoning by Eggs.— In some persons eggs when eaten produce symptoms of poisoning. This is to be considered an abnormal condition. But in several instances unmistakable indications of poisoning from eggs have been observed in persons who are not usually affected by such diet. This kind of poisoning is attributed to the presence of toxic bacteria, and is considered to be of the same nature as ptomaine poisoning and to be treated in the same way. Fortunately such cases are rare. See POULTRY.

Foreign Trade in Eggs.— Notwithstanding the very large domestic production, the United States imports a very large quantity of dried and frozen eggs annually. In 1917 this im-

portation amounted to 17,268,379 pounds, valued at $3,589,504. During the year the exports were also large, aggregating 19,886,079 dozen, valued at $7,270,543, and canned eggs valued at $171,112.

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EGG, or EIGG, ĕg, one of the Hebrides Islands, belonging to Inverness-shire, Scotland. It is south of Skye. Its length is a little less than seven miles.

EGG-BIRD, or **SOOTY TERN** (*Sterna fuliginosa*), a member of the gull family (*Laridæ*) famous for its edible eggs and breeding societies for "wide-awake fairs." It is found about warm seas throughout the world and abounds in the West Indies. Ascension Island is one of its most frequent breeding places. Occasionally it wanders at far as New England. The adults have beautiful black and white plumage, but the young are of a light, sooty color. The nests are rough excavations in the sand, in which three eggs are usually deposited. They are much valued and the gathering of them in the spring months forms an important West Indian industry. The name egg-bird is also commonly applied to other marine birds of the gull family, as guillemots, murres, etc., whose eggs are of economic value.

EGG DANCE, a once popular diversion in England, Scotland, Holland and some other parts of Europe; now confined chiefly to Spain, among the people of Valencia. A number of eggs were arranged in a prescribed form upon the dancing floor, and among them a blindfolded dancer moved as best he might, to music; the object being to execute an intricate dance without breaking the eggs. The music, like the arrangement of the eggs, was also prescribed.

EGG-EATING SNAKE, the *Dasypeltis scabra,* a tree-climbing species of coluber found in Central and South Africa. It is about two feet in length and is unique in its adaptation to the diet from which it derives its name. While the jaws are almost destitute of teeth and capable of great distension, a substitute for the teeth is found in the elongated hypophyses or ventral processes of several of the cervical vertebræ, which project into the interior of the œsophagus as a series of saw-like teeth tipped with very hard cement substance. This mechanism enables the snake to secure the entire contents of an egg as large as a hen's without losing a drop, for it is swallowed entire and only broken by contact with the œsophageal teeth when safely within the throat, when the contents are swallowed and the shell regurgitated. Consult Fitzsimmons, 'Snakes of South Africa' (Cape Town 1912).

EGG-FISH, any of various plectognath "globe-fishes," which swell themselves into the shape of an egg. See GLOBE-FISH.

EGG-PLANT, GUINEA SQUASH, or **AUBERGINE** (*Solanum melongena*), a plant of the family *Solanaceæ.* Its original home is supposed to be the East Indies, where it has long been cultivated and from whence it has been introduced into all tropical countries and many temperate ones for the sake of its egg-like white, yellow or purple fruits, which are used as a vegetable. In the United States it is cultivated as far north as Long Island and southern Michigan. In the North the plants must be started under glass and transplanted to the field or garden after danger of frost has passed. They do best upon rich deep loams well exposed to the sun. Their principal insect enemies are practically the same as those of the potato and are combated similarly. (See INSECTICIDE). Their fungus diseases are few and rarely devastating. The principal ones are a bacterial disease caused by *Bacillus solanacearum,* for which there seems to be no satisfactory remedy; anthracnose (*Glœosporium melongenæ*), which appears as pink-spotted sunken areas upon the fruits; leaf-spot (*Phyllosticta hortorum*), which turns the affected leaves brown and produces holes in them, and a mold (*Botrytis fasicularis*), which produces soft spots with gray moldy surfaces upon the fruits. Each of these parasites may appear upon any of the green parts, but the parts mentioned are the usual ones. They may all be controlled by timely applications of any standard fungicide.

EGG-TOOTH, the hard calcareous protuberance at the tip of the beak or snout of a chick or young reptile which is born within an egg having a tough shell, designed to assist the embryo in escaping. It wears a hole through the lining membrane of the egg, and then acts as a file to bore through the outer shell or wedge apart any crack. It is possessed by all birds and by such reptiles (turtles, lizards and snakes) as develop in eggs with hard coverings. Soon after the embryo goes free this excrescence falls off, and in this special temporary provision for a special non-recurring exigency, Darwin found an example, in his view, of the results of natural selection.

EGG-URCHIN, or **SEA-EGG,** any of the typical globose sea-urchins, especially those of the genus *Echinus.* Similarly, the flat, bun-shaped echinoderms are called "cake-urchins," the cockle-shaped (spatangoids) "heart-urchins," and so on. See ECHINODERMATA; SEA-URCHIN.

EGGA, ĕg'ą, West Africa, town of Gando, in the Niger territories on the Niger. Pottery, iron, gold and wooden-wares, thick cloth, generally dyed blue, and leather are manufactured, and an active river trade is carried on, especially in ivory. Pop. 12,000.

EGGAR-MOTH. See EGGER-MOTH.

EGGELING, Julius, English philologist: b. Hecklingen, Germany, 12 July 1842. After studying at Breslau and Berlin, he went to England in 1867, and on account of his knowledge of Sanskrit was appointed secretary and librarian of the Royal Asiatic Society 1869, becoming professor of Sanskrit at University College 1872 and filling the same chair at the University of Edinburgh three years later. Among his publi-

cations are 'The Catapatha-Brahmana, Translated according to the Text of the Madhyandina School' (1882–85); 'Catalogue of Buddhist Sanskrit Manuscripts in the Possession of the Royal Asiatic Society' (with Cowell 1875); 'Catalogue of Sanskrit Manuscripts in the Library of the India Office' (1887–89); and editions of 'Vardhamana's Ganaratnamahodadhi' (1879–80); the 'Katantra' (1874–78), and of the 'Kanva Satapatha Brahmana' (1902).

EGGER-MOTH, the name of certain species of *Lasiocampid* moths, allied to the silkworm moths. Several species are found in European countries. The American species is the lappet-moth or *Americana gastropacha.*

EGGLESTON, Edward, American novelist and miscellaneous writer: b. Vevay, Ind., 10 Dec. 1837; d. Joshua's Rock, Lake George, N. Y., 3 Sept. 1902. He entered the ministry of the Methodist Church and was more or less engaged in pastoral work for a number of years, at the same time contributing to various periodicals. He became literary and afterward superintending editor of the New York *Independent;* later, editor of *Hearth and Home.* From 1874 till 1879 he was engaged in the work of an independent church founded by himself (the Church of Christian Endeavor, Brooklyn), but in the latter year his health failed and he resigned his position as pastor. Subsequently he devoted himself entirely to literary work. Among the most important of his works are 'The Hoosier Schoolmaster' (1871); 'The End of the World' (1872); 'Mystery of Metropolisville' (1873); 'Schoolmaster's Stories for Boys and Girls' (1873); 'The Circuit-Rider' (1874); 'Christ in Literature' (1875, edited); Christ in Art' (1875, edited); 'Roxy' (1878); 'The Hoosier School-boy' (1883); 'The Graysons: a Story of Illinois' (1887); History of the United States and Its People' (1888); 'Household History of the United States and Its People' (1888); 'The Faith Doctor' (1891); 'Duffels,' a series of short stories (1893); 'The Beginners of a Nation' (1896) and 'The Transit of Civilization' (1900). His work as an historian possessed much merit, in that it was based upon careful investigation and exhibited sound judgment. Yet it is by his early stories of the Middle West that he will always be best known. These stories gave to those who read them at that time a real delight. They were written without the slightest trace of literary art; but their themes were wholly novel, and the unstudied simplicity of their narrator made them so natural and so life-like as at once to charm and surprise all sorts of readers. 'The Hoosier Schoolmaster' may be regarded as the first of a class of stories of which 'David Harum' and 'Eben Holden' are much later examples. The book in reality marked a new departure in our national literature, for it owed absolutely nothing to any model, but was a tale told directly from life, and from American life of a primitive kind which had not before made its way into printed books. He became in 1900 president of the American Historical Association. See HOOSIER SCHOOLMASTER, THE.

EGGS OF AMPHIBIA. See EGG.

EGGS OF BIRDS. See EGG.

EGGS OF FISHES. See EGG.

EGGS OF INSECTS. See EGG.

EGGS OF LOWER ANIMALS. See EGG.

EGGS OF MOLLUSKS. See EGG.

EGGS OF REPTILES. See EGG.

EGHAM, England, an urban district in the county of Surrey, on the Thames, about 21 miles west of London. It contains the Royal Indian Engineering College, the Royal Holloway College for Women, and the Holloway Sanatorium. Runnymede, where King John signed Magna Charta, is in Egham parish. Pop. 12,551.

EGHERT, ĕg-ert, **Saint,** an English saint: b. Northumbria; d. Iona, 24 April 729. While studying in Ireland at the convent of Rathmelsing he was afflicted by the plague prevalent in 664. He vowed that if he recovered he would leave his country and preach to the German pagans, recite his psalter daily and fast a day and a night in every week. In 686 he started out but was compelled to return by a storm. He then took up his residence on the Island Hy from which he sent Witbert, an Englishman, to the Frisians in 690. In 692 he sent forth Willibrord and his companions. He introduced the Roman method of celebrating Easter and the Roman tonsure. In 716 he went to Iona and persuaded the monks to follow the same customs.

EGIL SKALLAGRIMSSON, ā'gĭl skăl-lă-grĭm'sŏn, Icelandic bard or skald of the 10th century. He distinguished himself by his warlike exploits and adventures in Norway, Denmark and England. Having killed in combat the son of Erik Blódöx, King of Norway, he was doomed to death on being subsequently taken prisoner by that prince in Northumbria, but was allowed to redeem his life by giving a specimen of his powers as an improvisatore. He immediately composed and recited a poem in praise of Erik, known as 'Höfudhlausen' (The Redemption of the Head), which procured him his life and liberty. Other works by him are 'Sonatorrek,' composed on the death of his favorite son; 'Arinbjarnardrápa' concerning the life and deeds of his friend Arinbjörn, and the 'Skjaldardrápa' (970). The Icelandic poem 'Egill's Saga' tells his story and contains his poems. The 'Saga' was edited by Jónsson (1884–86 and 1894) and translated by N. M. Petersen (1862). The latest edition is by Dahlerup and Jónsson (1901).

EGILSSON, Sveinbjörn, svīn'bèrn ā'gĭlsŏn, Icelandic critic: b. Gullbringasysla, 24 Feb. 1791; d. Reikiavik, 17 Aug. 1852. He studied at Copenhagen and became rector of a Latin school at Reikiavik. He investigated the native antiquities, edited a series of Icelandic historical works, and completed a 'Poetic Lexicon of the Ancient Tongue of the North' (1855–60), published posthumously.

EGINHARD, ā'gĭn-härd, or EINHARD, īn'härd, German historian: b. East Franconia, now the grand duchy of Hesse-Darmstadt, about 770; d. Seligenstadt, 14 March 840. He was educated in the schools of the abbey of Fulda. When about 25 he entered the service of Charlemagne and thereafter was in all things

the confidant of the emperor and one of the principal ministers. One of his great charges was the construction and repair of the public buildings. He was inseparable from the emperor, residing in the palace and accompanying him in all his journeys and expeditions: the only time when they were temporarily separated was when, in 806, the secretary — for such he has always been called — went to Rome to obtain the approval of the Pope of a provision of Charlemagne's testament or will for a division of the empire among his sons after his death. That Eginhard possessed considerable learning appears from his extant writings. During his many years of study at Fulda he acquired all the secular knowledge obtainable in his time, and in the palace of Charlemagne enjoyed the advantage of converse with the celebrated Alcuin. It was on the advice of the secretary that Charlemagne in 813 made his eldest son, Louis, his partner in the empire; and when Louis, on his father's death, became sole emperor, he retained Eginhard in all his high offices and appointed him tutor of his son Lothair. In 830 he withdrew from the court and retired to his large estates at Mulinheim, where he had erected a splendid basilica and founded various religious institutes, and there passed the remainder of his life. He changed the name of the place to Seligenstadt (City of the Saints, namely, of Saints Marcellinus and Petrus). In this basilica he was entombed, beside his wife, Emma, who died four years before him. According to an old legend Emma was a daughter of Charlemagne, and as time went on the story of their love adventures was added to from the fount of romantic imagination: in fact, Charlemagne had no daughter named Emma, and the lady Emma who was Eginhard's wife was the sister of Bernharius, bishop of Worms. Eginhard's 'Life of Charlemagne (*Vita Caroli Magni*), written in Latin in a style and imitative of Suetonius' 'Lives of the Cæsars,' is one of the most notable literary monuments of the Middle Ages; it was long used as a manual of school instruction and hence has survived in a multitude of manuscript copies. Another work of his is a history of the Franks, 'Annales Regum Francorum, Pippini Caroli Magni et Hludowici Imperatoris' (Annals of the Frankish Kings Pippin, Charlemagne and Louis the Emperor). There are extant 62 of his 'Letters' (*Epistolæ*), and a narrative of the translation from Rome to Seligenstadt of the relics of Saints Marcellinus and Petrus ('Historia Translationis Beatorum Christi Martyrum Marcellini et Petri'). To the narrative he appends a poem on the same subject.

EGLANTINE, ĕg'lăn-tīn or -tĭn, the name of the sweet-brier rose (*Rosa rubiginosa*), in the poetry of Chaucer, Spenser and Shakespeare. The name is common among the English poets; the earlier ones applied it to any wild rose, and Milton seems to confound several different species, among them the honeysuckle, etc. The flower is a native of Europe and Asia, but was easily naturalized in America and, being hardy, it withstood the severe winters, and now grows in profusion in the territory from Nova Scotia to Ontario, south to Tennessee, and east to the shores of Virginia. It is from four to six feet high, sometimes growing as a long spine-covered wand. The pink or white flowers are a marked feature of the flora of this region, during the months of June and July. A climbing-shrub, native of Asia (*Rosa eglanteria*), with yellow, ill-smelling flowers, is also sometimes called eglantine.

EGLESTON, Thomas, American mineralogist: b. New York, 9 Dec. 1832; d. there, 15 Jan. 1900. He was graduated at Yale College in 1854, and at the School of Mines in Paris in 1860. He returned to the United States in 1861; and soon afterward was appointed director of the mineralogical collection and laboratory of the Smithsonian Institution in Washington. He established the School of Mines as a department of Columbia College, New York; and was professor of mineralogy and metallurgy there 1864–97. He was a United States commissioner to examine the fortifications of the Atlantic coast in 1868; and one of the jurors of the International Exposition at Vienna in 1873. He became a member of the Legion of Honor (1890); president of the American Institute of Mining Engineers, of which he was also a founder, and vice-president of the New York Academy of Sciences 1869–81. He published 'The Metallurgy of Gold and Silver in the United States'; 'A Catalogue of Minerals and Their Synonyms'; Life of Major-General Paterson, of the Revolutionary army.

EGLI, ā'glē, Johann Jakob, Swiss geographer: b. Uhwiesen-Laufen, canton of Zürich, 17 May 1825; d. 1896. He was made professor of geography at the University of Zürich 1883, after teaching in several schools, and did much for the accuracy, precision and uniformity of the nomenclature of geography. Among his earlier works are a thesis on the 'Discovery of the Sources of the Nile'; and a 'Geography of Switzerland.' Later works include 'Nomina Geographica: Versuch einer allgemeinen geographischen Onomatologie'; 'Geschichte der geographischen Namenkunde'; 'Neue Erdkunde'; 'Neue Handelsgeographie'; and 'Der Völkergeist in den geographischen Namen.'

EGLON, A king of Moab mentioned in the book of Judges (iii, 13, iv, 20). He formed a confederation with the Amalekites and Ammorites ruling over them for 18 years until assasinated by Ehud, the Benjaminite, who defeated his leaderless peoples and gave them deliverance and a peace which lasted for 80 years. Eglon is also the name of a place mentioned in the book of Joshua (x, 1–27, xii, 12) located not far from Lachish. Its king Debir joined the Confederation opposed to Joshua's advance into Canaan. After the battle of Ajalon it was destroyed. It has been identified by leading archæologists with Tell Nejleh.

EGMONT, Justus van, Flemish painter: b. Leyden 1602: d. Antwerp, 8 Jan. 1674. He was a pupil of Kaspar Van den Hoeck (1651) and later of Rubens. He established himself at Paris where he became court painter to Louis XIII and Louis XIV, and was also one of the founders of the Royal Academy of Painting and Sculpture 1648. Among his works are 'Portrait of Archduke Leopold William'; two 'Portraits of Philip IV. of Spain' (Vienna

Museum); 'Maria de Medici' (Schleissheim Gallery); and 'Portrait of Queen Christine.'

EGMONT, Lamoral, COUNT, Dutch statesman: b. La Hamaide, Hainault, 18 Nov. 1522; d. Brussels, 5 June 1588. He entered the military service, and gained a high reputation under Charles V; distinguished himself as general of cavalry under Philip II; and was made stadtholder of the provinces of Flanders and Artois. His connection with the Prince of Orange and his most distinguished adherents made him an object of suspicion to the Spanish court, and Egmont, with Philip of Montmorency, Count Hoorn, became the victims of hate and fanaticism. The Duke of Alva sent by Philip II to the Netherlands in 1567 to reduce the insurgents, had Egmont and Hoorn treacherously seized, and caused them both to be executed at Brussels. Egmont died with heroic firmness. He had before written to Philip II, that "he had never joined in any undertaking against the Catholic religion, nor violated his duties as a loyal subject.' But the Prince of Orange having taken the field as the champion of his country's wrongs, an example was thought necessary to strike terror into the insurgents. There can be little doubt that the Spanish king unnecessarily dreaded the influence of the gallant soldier but incapable politician. When the troubles in the Netherlands broke out, Egmont, moved by generous sympathy for his injured countrymen, rather than by any fixed principle of action, was found side by side with the Prince of Orange, in the van of the malcontents. But in opposition to the popular movement came his strong feeling of loyalty to Spain, and his still stronger devotion to the Roman Catholic faith. Thus, the opposite forces by which he was impelled neutralized each other, and, ever acting from impulse, he did not calculate the consequences of his conduct. Consult Motley, J. L., 'Rise of the Dutch Republic' (London 1861); Juste, T., 'Le Comte d'Egmont et le Comte Hoorn' (1862); Goethe, 'Egmont,' a drama; Brunelle, 'Éloge du Comte Egmont' (1820).

EGMONT. Goethe began work on his tragedy of 'Egmont' (1788) as early as 1775, in the period of his "storm and stress"; and as in 'Götz von Berlichingen' he had represented a champion of liberty and self-reliance doomed to defeat in a time of all-powerful tyranny, so in the revolt of the Netherlands — which he carefully studied — he was especially attracted by another victim of despotism, another prophet of a better age. Goethe's 'Egmont' is, however, an historical character in hardly anything but his execution at the hands of the Spaniards. He is, rather, like Goethe himself, young, demoniacal, improvident, trustful — a lover and a patriot, the idol of the people, but in no sense their leader. This character Goethe presents in a setting of popular turmoil and political intrigue, revealing itself in its abhorrence of both, but particularly in its serene self-abandonment to love of an humble maiden. Egmont's Klärchen is, if it be possible, as naïve a martyr to purely human impulse as Gretchen in 'Faust.' And this play, otherwise quite realistic, ends with an operatic apotheosis of Egmont's beloved: in a dream he sees her as the goddess of liberty, ready to crown him with a wreath.

Schiller rightly defined 'Egmont' as a tragedy of character. There is no development of qualities in the hero, there is no dramatic conflict; there is merely a stratagem in which he allows himself to be ensnared. Egmont's very being is fatal, not his conduct; for he does not act. The whole piece is rather potentially than actually dynamic. There are clear-cut figures and popular scenes of truly Shakespearean vividness, but the prevailing quality is picturesqueness — else, perhaps, Beethoven's incidental music would not be so appropriate. Completed in Italy, the play reveals Goethe's later classical tendencies chiefly in the scrupulous finish of its prose style. Translated by F. Boott (Boston 1871), and by Sir Walter Scott (London 1850). Edited by Max Winkler (Boston 1898).

WILLIAM G. HOWARD.

EGOISM, ē'go-izm (Fr. *egoisme;* Lat. *ego.* "I"), an ethical term used in the sense of selfishness; it is specially opposed to altruism. The word is sometimes used to denote a metaphysical system of subjective idealism, in which the Ego is the sole reality. See ALTRUISM; ETHICS.

EGOIST, The (originally published in 1879), may be described as the quintessence of Meredithism. That "acute and honorable minority," which in the eighteen-nineties made it their business to "discover" the great obscure novelist, with James Thomson, Stevenson and Henley, as their earliest proselytizers, proclaimed 'The Egoist' as the supreme and occult masterpiece of its author. Appreciation of it was made the touchstone of literary intelligence, much as the later novels of Henry James, a decade or so afterward, were regarded by "the precious" of the day. When one says that in those novels of Henry James we have the method and manner of 'The Egoist' run to seed, we go far toward characterizing the book from which James learned not wisely but too well. 'The Egoist' is an exceedingly elaborate, and so to say microscopic, study of a sort of sophisticated modern Lovelace, Sir Willoughby Patterne of Patterne Hall, handsome, cultivated, rich, charming, and yet dissected under the pitiless eye of that "Comic Spirit," which Meredith invokes as his muse, a muse that loves "to uncover ridiculousness in imposing figures," supremely and mathematically absurd in his very perfection and complacency. "Comedy," says Meredith by way of prelude, "is a game played to throw reflections upon social life, and it deals with human nature in the drawing-room of civilized men and women, where we have no dust of the struggling outer world, no mire, no violent crashes, to make the correctness of the representation convincing." In other words, the atmosphere of 'The Egoist' is one of intense social rarefaction, and the drama, such as it is, that of 'Fire Shades,' only perceptible by the highly specialized beings accustomed to draw health in that social ether. The hard brilliancy of 'The Egoist' is undeniable. It is more like one of Congreve's comedies than anything else in English, but it is Congreve psychologized; for instead of human beings for *dramatis personæ,* we have highly attenuate states of mind; and the philosopher takes the place of the man of the world. The style and mood also too frequently remind one of John

Donne, fantastically metaphysical and perversely obscure. While we admit that it is an amazing *tour de force*, one cannot but ask whether it was worth doing, after all? That such great powers should have expended themselves, with such an array and exuberance, upon so slight a theme — a theme, of course, so essentially human, but in the case of 'The Egoist,' attacked in so frivolous a manifestation. It is probable, as time goes on, that 'The Egoist' will be regarded chiefly as a "curiosity of literature," one of those cryptic great books such as the 'Titan' of Jean Paul Richter — a writer who, with Carlyle, exercised great influence for the bad on Meredith's style. Book-lovers here and there may pick out this and that fine thing and passage, but posterity, on the whole, will scarcely have time or patience to read 'The Egoist.'

RICHARD LE GALLIENNE.

EGRET, ē'grĕt, a name given to those species of white herons which have the feathers of the lower part of the back elongated and their webs disunited owing to the absence of barbules at certain seasons of the year, so that they form a soft and flowing train reaching to the tail or beyond it. Their forms are more graceful than those of the common herons. The name is properly applied to two American and two European species. The American egret (*Ardea egretta*) has the plumage white, or partly of a creamy color. The bird is found breeding from Florida to New York and along the shores of the Mexican Gulf to Texas, but ranges much beyond these limits at other seasons. Its food consists of the smaller quadrupeds, small fishes, frogs, lizards, snakes and insects, and it breeds like other herons. The long silky filaments of the back are hardly to be seen, except about the love season, which varies from early spring to midsummer according to climate; both sexes possess this train and many are shot to obtain these feathers for ornamental purposes. The little white egret or snowy heron of America (*A. candidissima*) is much smaller and has a crest on the head which the large species lacks. In habits and distribution it is similar. The European egret (*A. alba*) is about 40 inches long, of a pure white plumage. It is common in southern Europe, but comparatively rare in the northern and central parts. The little egret (*A. garsetta*) is about 22 inches long from bill to end of tail; the plumage is white; from the hinder part of the head spring two narrow feathers four inches long. This species is most abundant in southern Europe and northern Africa; it occasionally wanders as far as England. The Louisiana heron (*A. tricolor*) and the reddish egret (*A. rubescens*) are often given the name, but the latter is white in winter only, and the former is partly colored at all seasons. Both are maritime birds, chiefly of the Gulf States.